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TEMPORARY AIR CARGO TERMINAL

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BAYONNE, NEW JERSEY

RESEARCH AND DEVELOPMENT DIVISION
BUREAU OF SUPPLIES AND ACCOUNTS
WASHINGTON 25, D. C.

TECHNICAL REPORT REVIEW

TEMPORARY AIR CARGO TERMINAL

Project NT003-020(t)
Sub-Project SE53-88
Engineering Report No. 2,4196
27 June 1955

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TEMPORARY AIR CARGO TERMINAL

Project NT003-020(t)
Sub-Project SE53-88
Engineering Report No. 2.419b
27 June 1955

by

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ABSTRACT

A prefabricated portable frame structure to be used as a portable air cargo terminal is described and evaluated. The structure can be transported by air to remote locations and erected without the use of heavy construction equipment. This report deals only with erection instructions and preliminary evaluation of the structure and covering.

SUMMARY

PROBLEM

The objective of this project is to develop a temporary air cargo terminal which may be transported by air to a remote location and erected by unskilled labor without the use of heavy construction equipment.

FINDINGS

A prefabricated structure, 62' wide and 16' high at the ridge and which can be built in 8' modules to any desired length, has been tested and evaluated together with a canvas cover and end sections. The end sections are constructed of kraft honeycomb and are faced with plywood.

The frame structure as designed is acceptable with indicated minor modifications pending an operational evaluation at a Naval Air Cargo Depot designated by the Bureau of Supplies and Accounts.

The canvas cover has been modified in order to make it acceptable. The end sections, as designed, are too heavy and cumbersome for efficient handling for air cargo.

RECOMMENDATIONS

It is recommended that:

1. New end sections be designed.
2. An operational evaluation be made at some Naval Air Cargo Depot.
3. Alternative methods of covering be evaluated.
4. Alternate means of insulating the structure be tested.

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Shelter, Frame Type, Gambella

62' Span, 8' Modular Section

Arch Details

Gamble Bros. Drawing No. G-307

NSRDF Drawing No. SED 471, Sheet 2

Shelter, Frame Type, Gambella

62' Span, 8' Modular Section

Arch Profile

Gamble Bros. Drawing No. G-311

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Shelter, Frame Type, Gambella

62' Span, 8' Modular Section

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TEMPORARY AIR CARGO TERMINAL

INTRODUCTION

The concept of tactical military support is constantly being re-evaluated due to technological advances. Increasing demands for air cargo transportation have created new problems in logistics and air cargo terminal facilities.

The nature of air cargo packaging is such that it affords limited protection similar to that afforded packages shipped domestically and, as such, it is assumed that they will not be exposed to the rigors of exposure and rough handling. It follows, therefore, that when a package arrives at an advance base or jungle airstrip, it must be protected from the elements until it is consumed or transshipped.

The portable shelters in use today are adequate for limited storage of small containers. These shelters, however, are too small for efficient staging of "en route" shipments. In addition, the designs do not lend themselves to the use of mobile equipment such as fork trucks, tractors, etc. A large shelter that is easily constructed and has a large cubic capacity is needed for a staging area in which cargo is received and prepared for transshipment. This shelter must, of necessity, be equipped to store a large percentage of the containers likely to be shipped by air. It must be adequate for placement of pallet racks and various types of conveyors, with sufficient aisle space and overhead for maneuvering materials handling equipment.

Such a shelter may, of necessity, be required to be transported by air to remote locations. In many cases skilled labor and heavy construction equipment, such as cranes, may not be available for erection. The structure, prior to assembly, must fit within a cargo air frame and should be light enough to be economically transported.

An arctic maintenance hangar for Army liaison aircraft was designed by the Army Quartermaster Corps and engineered by the Forest Products Laboratory, Madison, Wisconsin, and Gamble Bros., Inc., Louisville, Kentucky, under a research contract with

Mechanical Product's Branch, Research and Development Division, Office of the Quartermaster General, and Textile Products Division, Quartermaster Research and Development Laboratories, Jeffersonville, Indiana.

A modification of the above hangar was procured by the U. S. Naval Supply Research and Development Facility, Bayonne, for evaluation as a temporary Air Cargo Terminal.

Engineers from the Naval Supply Research and Development Facility visited Gamble Bros., Inc. to inspect a similar structure in use as a warehouse. The frame structure contracted for by the Naval Supply Research and Development Facility was then erected on Gamble Bros. property using unskilled labor from the Naval Ordnance Plant, Louisville, Kentucky, and a small mobile crane in order to familiarize Naval Supply Research and Development Facility engineers with construction and erection problems and procedure. The structure was then dismantled and shipped to Bayonne where it was again erected. No cranes were used at Bayonne to assist erection. Time studies were taken concurrently with construction and dismantling at both sites.

At Bayonne, the canvas cover and the end sections were fitted and evaluated. The need for changes in design was apparent during the hurricanes in the fall season. The cover and end sections have been altered to make them serviceable.

An operational evaluation will be made at a Naval air cargo transshipment point in the near future. After operational tests, a final design will be made incorporating any features that were found necessary and desirable.

DESCRIPTION OF PROCEDURES FOLLOWED

The structure was assembled and disassembled twice in order to ascertain the most efficient method of erection and to disclose any inadequacies in design.

Some of the more important deficiencies were corrected at the Naval Supply Research and Development Facility in order to render the structure usable. Additional drawings of the redesigned cover which conform to the required design are included.

The end sections have been altered in order to make them operable. These alterations still leave much to be desired; however, no radical changes have been made as it would involve additional delay and expense. Recommended changes have been incorporated in the text of the report.

LABOR TIME

Actual erection time of the structure at Louisville, Kentucky, using Naval Supply Research and Development and Naval Ordnance Depot personnel, under ideal weather conditions, was one hundred eighty-six (186) man hours.

A mobile crane was used to assist in raising the bays. The only equipment other than hand tools consisted of stepladders of varying heights. Personnel erecting the structure at Louisville had no prior knowledge of the structure. Blueprints were available but there were no erection instructions. Some advice of a disinterested nature was received from Gamble Bros. personnel during intermittent visits to the building site. The canvas covering was not available at the time of this erection. The structure was dismantled and sent to Bayonne for further time study and evaluation.

Actual dismantling time for the structure at Louisville was forty-nine (49) man hours. A mobile crane was utilized in this operation and the crane operator's time is included in the time totals.

Erection of the structure at Bayonne, utilizing special jacks and ladders, was two hundred thirty-two (232) man hours. No crane or other mobile equipment was used. Weather conditions were poor. The structure was erected on a field covered with snow and ice. Sand and rock salt were used to keep the area safe for personnel. The cold weather lowered the normal efficiency of the riggers.

At Bayonne, the labor crew erecting the structure received over-all supervision from the project engineers. After the first bay was erected the labor crew continued alone except for intermittent inspections.

A fair evaluation of the time involved to cover the structure has not been made. Seven hundred (700) man hours were required

to install the end sections and the inner and outer blankets. Many changes were necessary to make the covering acceptable and various methods of fitting the covering were tested in order to find the easiest and fastest method. The end sections required considerable modification before fitting the structure.

It is estimated that fitting the exterior blanket would require the labor of four (4) men for one day. An estimate of fitting the interior blanket depends upon the equipment available at the building site. Most of the work will have to be performed on a fork truck equipped with a safety pallet, staging, or ladders. These aids have to be moved about constantly, requiring additional labor and time. When the terminal is erected at an operating airfield a more realistic time stud, will be available.

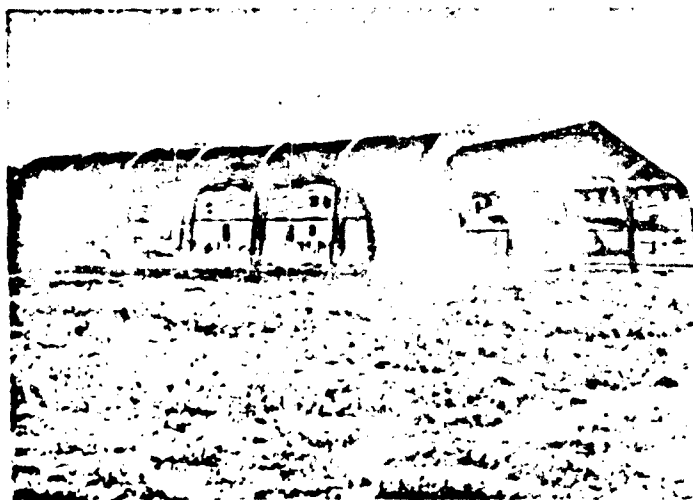
DESCRIPTION OF FRAME STRUCTURE

The entire frame structure is made up of sections which may easily be handled by one or two men. The basic structure is supported by steel plates which are laid on the bare ground. Arches, in sections, are formed of laminated hardwoods and are bolted together. Accordion type lattice work is slipped into fittings on these arches forming an 8' bay supporting the roof covering. The structure is designed on an 8' module, each arch being 62' wide and 16' 1" from the top of the base plate to the peak. The structure may be any desired length. The shelter undergoing tests at Bayonne consists of six 8' sections or bays, giving an over-all length of 48'. (See Figs. 1 and 2).

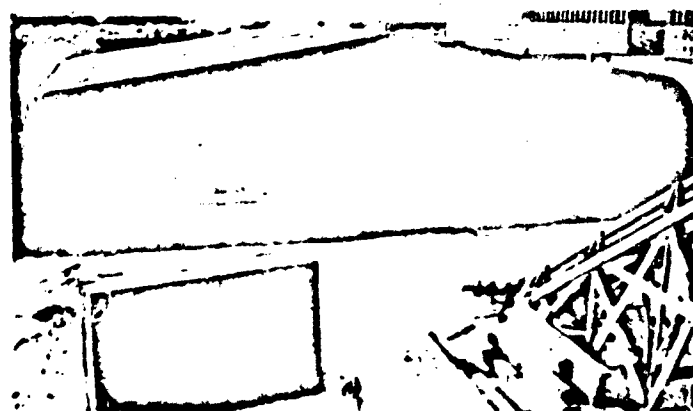
One completely assembled 8' bay embodies approximately 5,800 cubic feet and weighs approximately 1,950 pounds. The total shipping weight of a six bay frame is approximately 13,750 pounds. The structure was designed for a total load of 12 pounds per square foot of roof area and was tested at 25 pounds per square foot, with no permanent distortion. The weight of the covering (interior and exterior blankets) and end sections totals 6,842 pounds, consisting of the followings:

1 top blanket	145 lbs.	total (6)	870 lbs.
1 interior blanket	88 lbs.	total (6)	528 lbs.
1 end section	2,722 lbs.	total (2)	5,444 lbs.
			6,842 lbs.

The total weight of structure, covering and end sections is approximately 20,592 pounds.



**Fig. 1. - Assembled frame structure without covering. NSRDF
Neg. No. 275-15.**



**Fig. 2. - Completely covered structure. End section fully opened.
NSRDF Neg. No. 216-1.**

DESCRIPTION OF PARTS⁽¹⁾

Base Plates and Tensioning of Ground Cables (Figs. 3 and 4)

Base plates support the arches and are formed of 1/4" steel plate. Two plates welded to hinges attached to the base plate are fitted with bolt holes and support the arches.

The extreme end arches of the structure are placed between the hinged plates (Fig. 3). The inner arches are placed on the outside of the hinges and a rectangular wood spacer is placed between the hinges (Fig. 4). Two holes are provided on the base plate to permit stakes to be driven through the plate or permit bolts to anchor the structure.

A steel ring is also provided on the base plate for attachment of a tensioning cable which connects to the base plate on the opposite side of the structure. The cable prevents the base plates from moving outward and possibly collapsing the structure. A turnbuckle is provided on the cable for tensioning or slacking and it is also used to adjust the arch to the correct dimensions.

Circular wooden spacers (Fig. 5) are inserted between adjacent bays and bolts are inserted in holes provided in these spacers and on the arches to tie the bays together. The spacers are 2" wide and 3" in diameter. In addition to providing rigidity to the structure, a 2" clearance is maintained between adjacent arches.

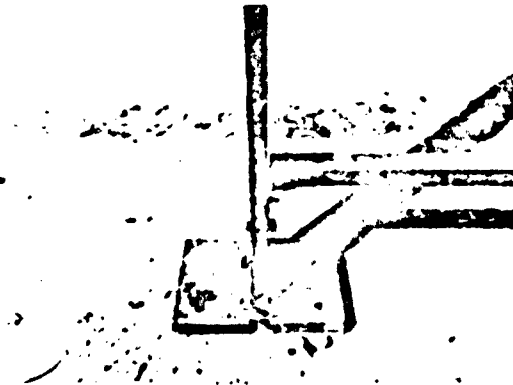


Fig. 3. - Base plate assembly of end arch. Arch is placed between hinged steel plates. NSRDF Neg. No. 275-9.

⁽¹⁾ Drawings of parts and structure are included in Appendix A.

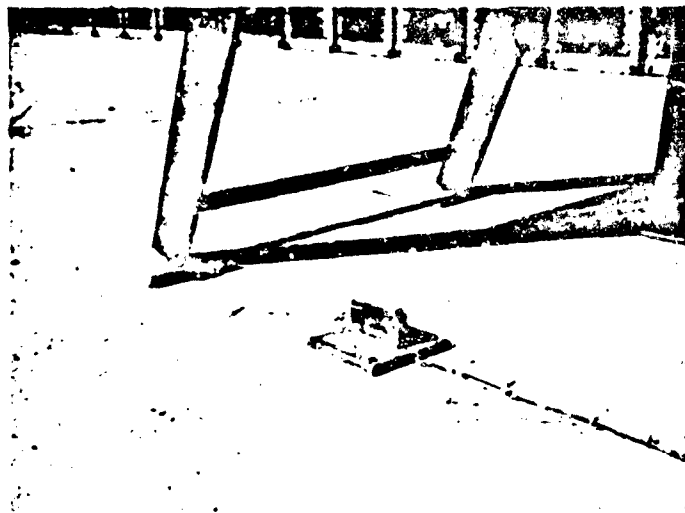


Fig. 4. - Half bay resting on skid plates. Base plate assembly with turnbuckle and tensioning cable is also shown. NSRDF Neg. No. 275-11.

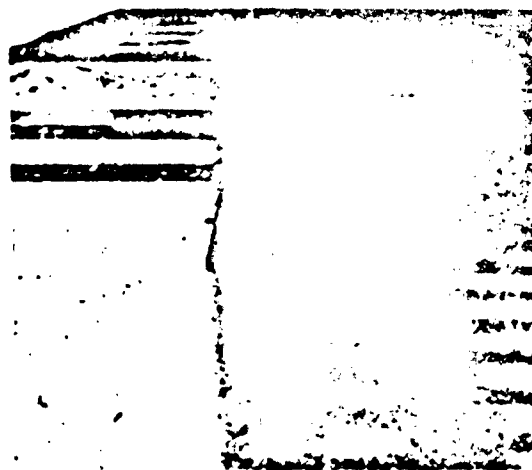


Fig. 5. - Assembly between two bays. Circular wooden spacer is shown between arches above purlins. Rectangular wooden spacer is shown between hinged steel plates on base plate. NSRDF Neg. No. 275-4.

Arches and Fish Plates

The assembled arches (Fig. 6) are constructed in six parts, three to each half. The lower arch section, or knee, is bolted to the base plate. The center arch segment and upper arch segment are bolted together with the use of connector or fish plates. The two halves of the arches are also connected by a fish plate (Fig. 7).

Purlins, Gambellas and Top (Ridge) Beam

Three purlins are provided for each half bay (Fig. 8). They are constructed of 3 ply laminated hardwood. The cross sectional dimensions are $2\frac{3}{16}$ " x $3\frac{1}{2}$ ". Purlins bolted to the arches are used as additional stiffeners and maintain width dimensions while inserting gambella sections.

The gambella (Fig. 8) is the accordion type lattice work connecting two arches and lends support to any covering for the structure. The gambellas are constructed of 3 ply laminated oak and are placed in the gambella clips in the vertical plane. They are exceptionally strong and will easily support a 220 pound man. Gambella sections are provided in two sizes. The smaller gambella sections consist of 7 gambellas and are used on the underside of the arch. The larger sections consist of 14 gambellas and are placed on the upper edge of the arch.

Female gambella clips (Fig. 6) are screwed to the inside of the arches at regular intervals. The male fittings are hammered in place, care being taken that the gambella sections are matched. One top or center beam (Figs. 7 and 8) is provided for each bay and corresponds to the ridge beam in the common gabled roof. It is constructed of laminated hardwood and the cross section dimensions are $1\frac{5}{8}$ " x $7\frac{1}{2}$ ". It is bolted on a fish plate assembly that binds the two half bays together.

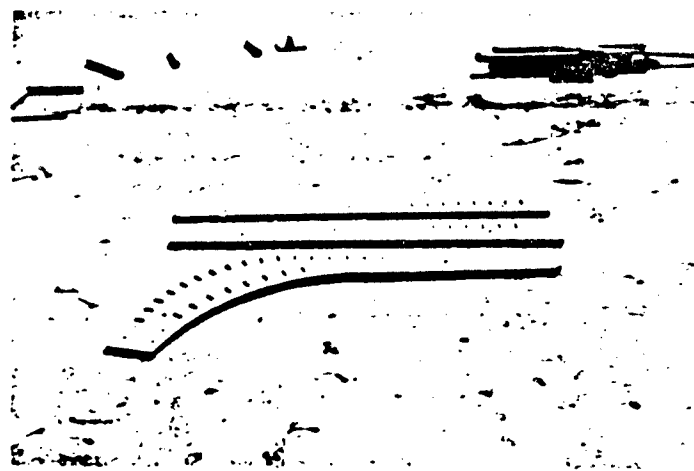


Fig. 6. - 1. Upper arch segment. 2. Center arch segment. 3. Lower arch segment (knee). Note female gambella clips attached to arch segments. NSRDF Neg. No. 275-10.

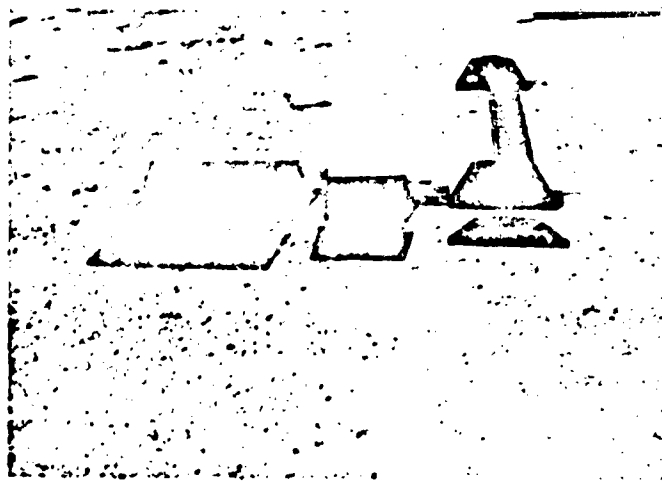


Fig. 7. - 1. Fish plate connecting lower arch segment (knee) to center arch. 2. Fish plate connecting center arch segment to upper arch segment. 3. Center fish plate and top beam (ridge) assembly. NSRDF Neg. No. 275-1.



Fig. 8. - 1. Purlin. 2. Gambella (compressed for shipment).
3. Top (ridge) beam assembled. NSRDF Neg. No. 275-2.

PARTS NUMBERING SYSTEM

Although nearly all parts are interchangeable, personnel seeing the structure for the first time may be confused. Therefore, a numbering system is provided for ease of assembly.

The six bays are lettered A, B, C, D, E and F. Facing the structure the nearest arch of the first bay is odd numbered. The after arch is even numbered. Numbers start from the left base plate (No. 1) and continue along the arch, each segment and fish plate receiving a consecutive odd number until the opposite base plate is reached.

The following numbers designate the parts of the first arch

- A1 Left base plate.
- A3 Left lower arch segment.
- A5 Fish plates connecting left lower arch segment to left center arch segment.

- A7 Center arch segment.
- A9 Fish plates connecting left center arch segment to left upper arch segment.
- A11 Left upper arch segment.
- A13 Center fish plate connecting left and right upper arch segments.
- A15 Right upper arch segment.
- A17 Fish plates connecting right upper arch segment to right center arch segment.
- A19 Right center arch segment.
- A21 Fish plates connecting right center arch segment to right lower arch segment.
- A23 Right lower arch segment.
- A25 Right base plate.

Parts numbered A2 through A26 form the other arch of the completed bay. With the exception of the end arches, one base plate serves two bays. Thus, base plate A2 will also show the number B1 as it is the start of the leading arch of the second bay. A26 will also be labeled B25. B2 will also show C1, and so forth.

STRUCTURE COVERING

The roof covering and end blankets are designed for normal loads and for wind loads of 55 MPH with gusts up to 85 MPH. The roof covering consists of two separate blankets. Drawings of the covering are included in Appendix B. They are constructed of vinyl coated cotton duck conforming to specification MIL-D-10799B and MIL-F-4143. The exterior blanket is olive drab in color and the interior blanket is light green (nile) in color.

The exterior blanket, as illustrated in Fig. 9, consists of six sections 82' long and 9' 1" wide, each section covering one complete bay. An additional snow or sod cloth 26" long is provided at the ends of each section. A storm flap 12" wide is also provided along one edge and overlaps the adjoining section.

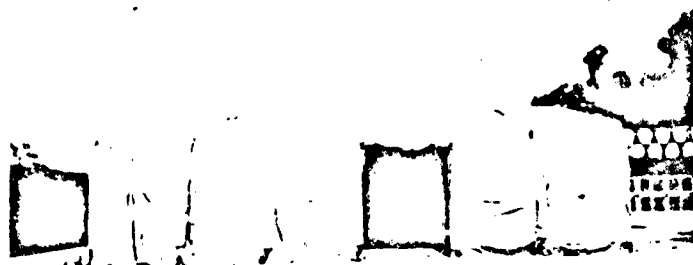


Fig. 9. - Completely covered six bay structure. A side opening has been provided by rolling back the exterior covering, removing gambellas and relocating purlins. NSRDF Neg. No. 216-4.

A 5/16" manila line is threaded through pockets provided along the edges of each blanket and serves as a drawstring arrangement for maintaining the proper tension and position of the blanket on the structure. On the blankets for the first and last bays the drawstring is eliminated on the outside edges and replaced with grommets. A 5/16" manila line is threaded through these grommets and hooks which are provided on the end sections to hold the blankets down (Fig. 11).

Due to the width of the blankets it was necessary to fasten Dee rings about 48" on center along the center line of the underside of the exterior blanket providing an additional hold down. When the roof blanket is placed in position, the Dee rings locate between the gambella assemblies. A manila line is then threaded through the Dee rings and underneath the gambella assembly. The roof blanket will be held firmly in place during strong winds by this means.

Slots are provided at the ends of each roof blanket for the insertion of a 2 x 4 purlin. These purlins distribute the stresses equally along the width of the blankets and prevent wrinkling.

Straps and double Dee rings are attached to the roof blanket to secure the storm flaps. Grommets are placed 3' apart on the side seams of the roof blanket. A rope is passed through adjacent grommet holes and attached to wooden toggles which drop between the adjacent arches. These toggles are pulled tight, then turned, bearing against the awning rail.

The interior blanket consists of six sections 80' long and 8' 2-1/2" wide (Fig. 10). Since no insulation is provided in the roof blankets, a dead air space is provided by fastening the interior skin to the underside of the roof structure. This is done by installing a stock aluminum extruded awning rail permanently to the lower edge of each arch. A 3/16" manila line sewn in each side hem of the interior skin slides in the awning rail and forms an air seal for the interior of the bay.

DESCRIPTION OF END SECTIONS

The end sections of the structure (Fig. 11) are of rigid construction. All panels (doors and gables) are constructed of 60 pound kraft honeycomb paper, laminated to 1/4" air cured Douglas fir plywood to form 1-5/8" thick structural members with a perimeter of Douglas fir sufficient in width to attach connecting hardware to the arch structure and door rails.

The gable ends are constructed in three sections with sh.p lap joints. The beam side of the gable is fitted with a monorail for swivel door rollers. The center gable section contains two 18" x 18" screen wire vents with insulated blackout flaps.

The doors are constructed in two 25' sections 10' in height. Each 25' section is hinged in 2' 6" ship lap sections, attached to swivel rollers at the top and swivel eyes through a cable at the bottom enabling folding to one side. The doors when folded will use a space of approximately 3'.

Wing panels are fitted on the end sections at the lower arch member or knee. On one side of each end section, the wing panels are fitted with a personnel door. Above the personnel door is a transom window fitted with plastic coated wire mesh. Above the transom is a heater duct opening. The opposite wing panel is blank but is fitted with a heater duct opening. These features are repeated on the other end of the structure. Heater openings are provided with covers in the event the openings are not needed.

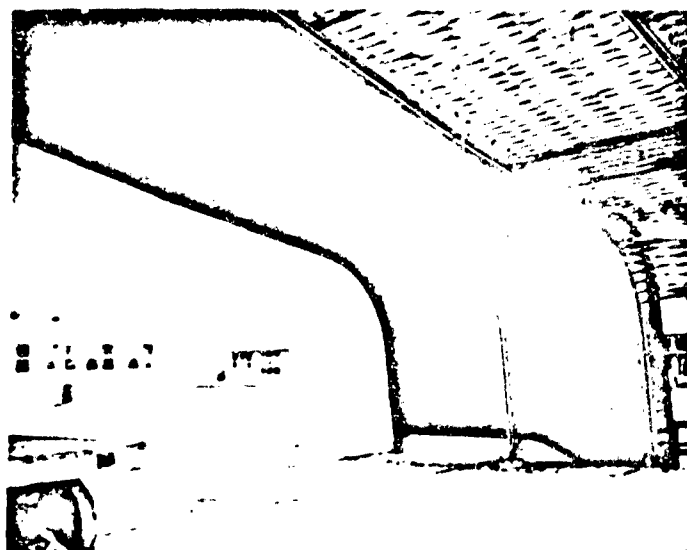


Fig. 10. - Interior view of partially covered structure. One section of interior blanket has been installed. A secured top blanket is also shown. Notice how the manila line passes through the Dee rings and under the gambellas. NSADF Neg. No. 107-2.



Fig. 11. - End view of structure, accordion doors closed. Toggle plates can be seen on alternate hinged door sections. These plates are used to keep doors in line. NSADF Neg. No. 216-2.

GUIDE TO ERECTION OF STRUCTURE

The erection of the frame shelter is simple and fast. One operation easily follows another if the operations are done in sequence and properly.

A logical division of personnel into crews would be:

1. Bolting arch segments - 2 men
2. Bolting purlins and installing gambellas - 4 men
3. Installation of wooden spacers and bolting center fish plates aloft - 2 men

The instructions give each operation complete in its proper order; it is not always necessary, however, to finish any one operation before the next one is begun. Much time can be saved by having the crews working on their respective portions of the work simultaneously; for example, the arch crew can be assembling arches (Fig. 12) while another crew is installing gambellas and purlins (Fig. 13). The entire crew should be available for raising the arches. Once the arches are raised, the tensioning cables secured, and a few spacers installed, the crews can go to their respective tasks.



Fig. 12. - Assembling arches on ground. Arches are placed on 2 x 4's in order to facilitate bolting fish plates. NSRDF Neg. No. 275-2.

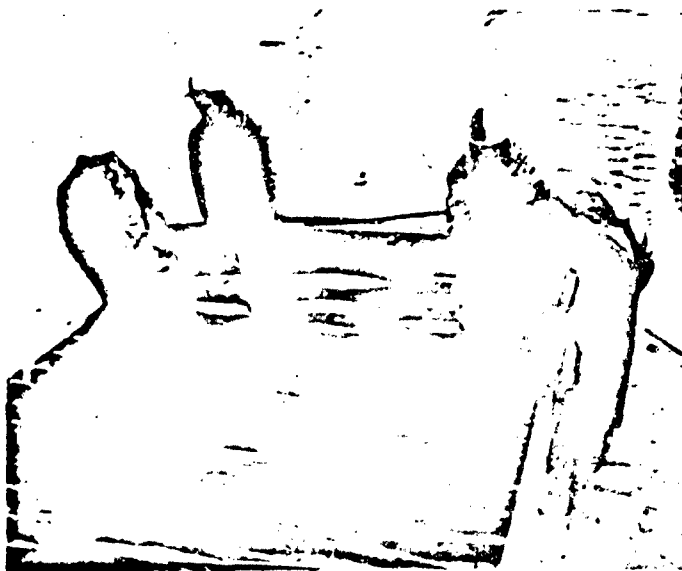


Fig. 13. - Crew installing gambellas. NSRDF Neg. No. 275-3.

Installation of gambellas is made easier if the following instructions are followed:

1. Two men should be stationed at each end of the gambella and stretch the collapsed member (Fig. 13).
2. During positioning only 2 or 3 slats should be stretched, the rest should remain in a collapsed position (Fig. 13).
3. Two men should position and hammer the gambella fittings into place. A rawhide hammer is used to prevent damage to the wood (Fig. 13).
4. If additional width is required to set the gambella pins, the gambella should be compressed; conversely, when the gambella is too wide the assembly should be expanded (Figs. 14 and 15).
5. The uninserted portions of the gambella unit should be held above the arch to prevent jamming (Fig. 13).
6. All the lower gambella units should be installed first.

As the team learns to work together, installation of the gambellas is speeded up. The stretchers have to coordinate their actions with the positioners. In some cases, installation of gambellas is difficult because the bays are too narrow or too wide. Figs. 14 and 15 illustrate how to correct this condition. It is most important to get off to a proper start by correctly aligning the height and width of the first bay. Otherwise, as the second and succeeding bays are added, the errors are magnified.

Each half bay, complete with purlins and gambellas, weighs about 1,000 pounds. Complete assembled arch members are easily moved by two men. Three or four men are required to stand up an arch prior to installing purlins. (See Fig. 16). The butt end of a complete half bay may be lifted by four men onto supports in order that jacks may be inserted underneath the arches or purlins. (See Fig. 17). The structure is so designed that no heavy construction equipment is required for erection. Two extension jacks (Fig. 18) are supplied with the structure for erection in the event motorized equipment is not available. Operating instructions are attached to the jacks so that they cannot be mislaid.

After the arches are assembled and the gambellas inserted, the arches are lifted and the jacks positioned under the arch and angled slightly toward the center of the structure (Fig. 18). When the arches are raised, the jacks will be vertical. Spacers are installed to secure the half bay to the adjacent bay. The other half bay is then raised and the two half bays are bolted together at the ridge. At this time, it is important to secure the ground cable to prevent the arches from sagging or collapsing.

The bays are aligned and the remaining spacers then installed securing two adjacent bays together. The jacks may be used to raise or lower the arch members in order to line up the spacer bolt holes.

Fig. 19 illustrates the danger of an improperly secured ground cable. Two men were installing the last bolt on the outside edge of the arch. The weight of the two men caused the base plates to move out of line resulting in damage to the structure and almost causing injury to personnel.

Time and labor saving devices in the form of mechanized equipment can be used to good advantage in the erection of this structure. A fork truck with a safety pallet will enable the men to work aloft without the necessity of moving high ladders or erecting and moving staging (Fig. 20).



Fig. 14. - Expanding gambellias to decrease width. When bays are too narrow, pull slats apart to shorten gambella length. NSRDF Neg. No. 275-6.



Fig. 15. - Compressing gambellias to increase width. When bays are too wide, compress slats to give greater width. NSRDF Neg. No. 275-7.



Fig. 16. - Crew installing purlins. NSRDF Neg. No. 275-17.



Fig. 17. - Half bay being raised by one jack. Jack is angled toward center of structure so that when the bay reaches the designed height, jack is vertical. Two men are holding guy lines. Improvised staging can be formed by using wood pallets. NSRDF Neg. No. 275-12.

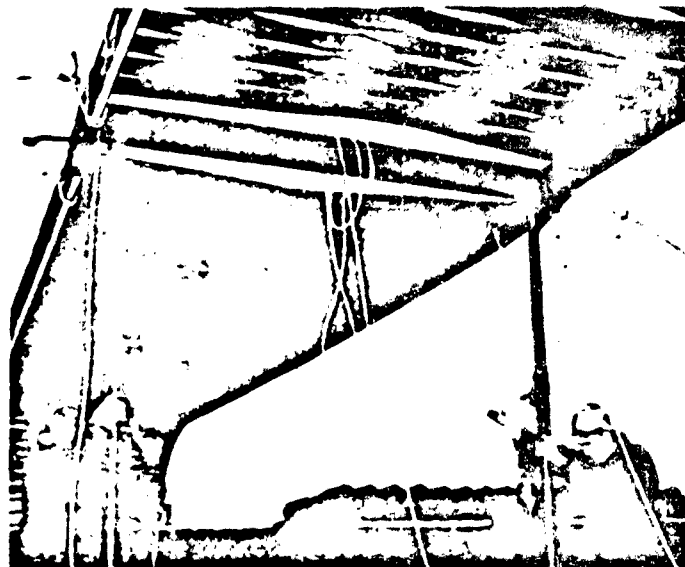


Fig. 18. - Extension jacks being used to raise two half bays at once. Skid plates (Fig. 4) are placed under one half bay and the other half is anchored on base plates. NSRDF Neg. No. 93-9.

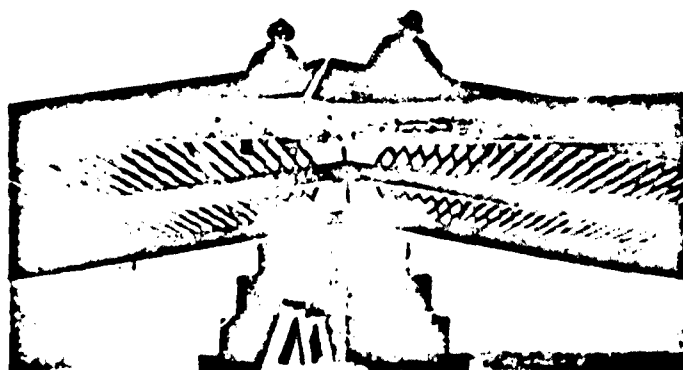


Fig. 19. - Partially collapsed and damaged arch due to unsecured ground cable. NSRDF Neg. No. 97-4.

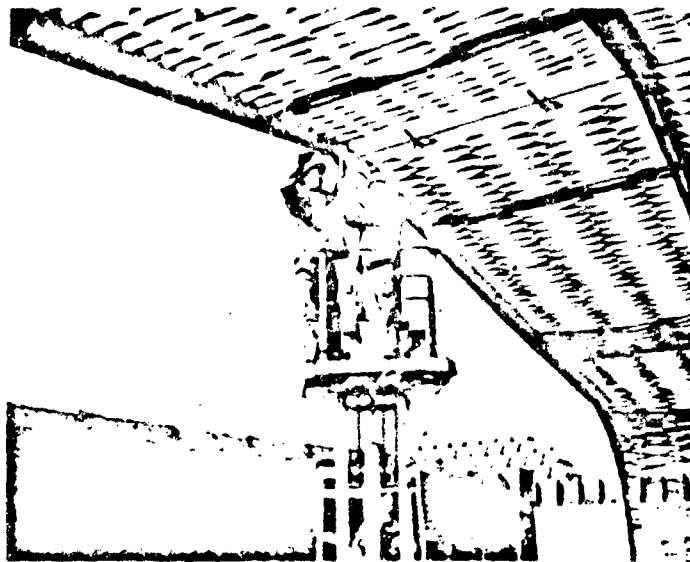


Fig. 20. - Fork truck and safety pallet being used to assist erection. NSRDF Neg. No. 275-5.

If a crane could be utilized in the raising of the bays (Fig. 21); or if the mechanized equipment is not available, wood staging, "A" frames, gin poles and other similar alternate equipment may be used (Fig. 22).

Material such as lumber for staging, concrete forms, etc., is not furnished with the structure. In most cases, this material is easily obtained from local sources. Specific problems encountered during construction may be solved in the field where all conditions are known. The easiest method of erection should be readily apparent when mechanized equipment is made available.

Drift pins and structural wrenches are used to line up bolt holes. The use of these pins prevents damage to the bolt threads and, in addition, prevents driving the steel inserts out of the lower arch segments.

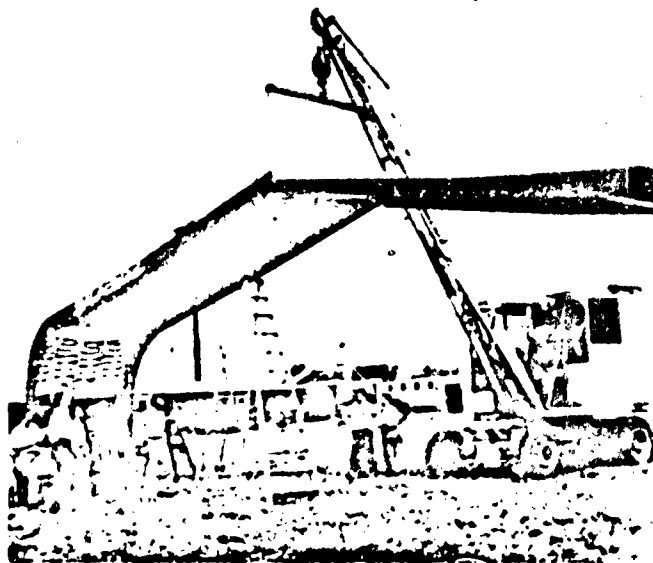


Fig. 21. - Raising structure by means of crane, NSRDF Neg. No. 275-16.

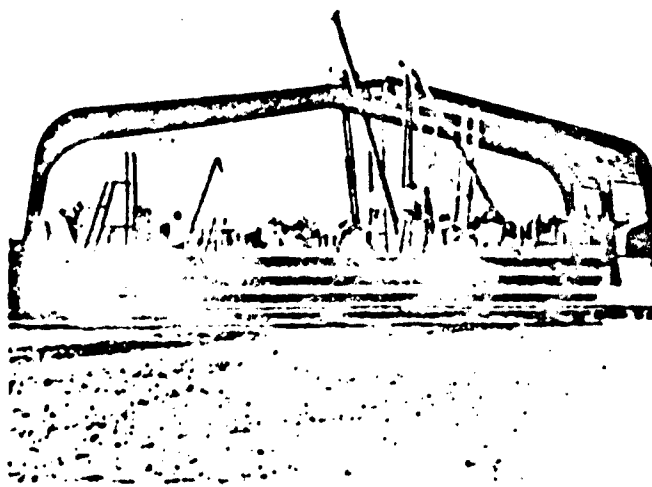


Fig. 22. - Gin poles being used for erection. "A" frames may also be used as an alternative, NSRDF Neg. No. 275-14.

TABLE I. TOOLS REQUIRED FOR ERECTION OF STRUCTURE

<u>Quantity</u>	<u>Description</u>	<u>Navy Stock No.</u>
6	1-1/8" structural wrenches	G41-W-3408
4	3/4" x 13/16" open end wrenches	G41-W-1012
4	9/16" x 5/8" open end wrenches	G41-W-1005
2	8" adjustable open end wrenches (heavy duty)	G41-W-486-5
1	Crowbar 1-1/8" 59-62" wedge point	G41-B-196
2	Offset pinch bars - 7/8" x 30"	G41-B-282
2	Screwdrivers - 5/16" x .042 tip	G41-S-1103
1	Double face sledge 10 lbs.	G41-S-3726
4	Rawhide hammers 2-1/4 lbs. 1-3/4" face	G41-H-471-175
4	Drift pins 7/8 x 7"	G41-P-603
2	3/4" backing out hammers	G41-P-2989-506
1	Line level	G41-L-1170
1	100' tape measure	G41-T-184

ERECTION PROCEDURE

Raising First Bay

1. The site of the structure should be fairly level and free of noticeable irregularities of terrain. A line level, supplied with the structure, will be helpful in determining levels.

2. Lay out corners of plot $50' \times 62-1/2'$. The arch will span a $67-1/2'$ width.

3. a. Lay out odd numbered "A" arch members on the ground.

b. Bolt A3, A7 and A11 with fish plates A5 and A9.

4. a. Lay out even numbered arch members "A" on the ground.

b. Bolt A4, A9 and A12 with fish plates A6 and A10.

5. a. Place base plate A1 at left front corner of plot.

b. Have $3/4" \times 2-3/4"$ bolts ready at base plate.

c. Raise half arch "A" and place between hinges on plate.

d. Place one bolt in hole nearest inside of structure and secure loosely. One or two men are required to hold arch erect.

6. a. Set base plate A2 - B1 approximately 8' away on a line toward the left rear corner of the structure.

b. Stand up hinges on base plate and place wooden spacers ("B" in drawings) between them.

c. Have $3/4" \times 6"$ bolts ready at base plate.

d. Stand up half odd numbered arch "A" and place outside of hinge on A2 side of plate.

e. Place one bolt through arch and hole nearest inside of structure through hinges and wood spacer and secure loosely.

7. While both arches are held erect, wooden purlins are bolted to half arches "A" tying them together.

8. Bolt top or ridge beam to A11 and A12 using fish plates A13 and A14. Only bolt lower holes and allow center beam section to swing loosely.

9. Install gambellas (see suggestions to erector).

10. Bolt A13, A19 and A23 arch segments with fish plates A17 and A21.

11. Bolt A16, A20 and A24 arch segments with fish plates A18 and A22.

12. Locate base plate A25 and raise arch as in instruction 5.

13. Locate base plate A26 and raise arch as in instruction 6.

14. Bolt on the two purlins on the lower arch members.

15. Install all gambellas except on the upper arch segment and secure gambellas with web straps.

16. Raise left arch to a sufficient height to enable setting one jack and raise to 10'. Guy lines are used to keep the arch from swinging.

17. Install purlin and gambella on upper arch members of right arch.

18. a. Raise both arches together to height 16' 1" from base plate to center fish plate.

b. When outside holes on base plates match holes in arches, place bolts and secure.

c. Place bolts in empty holes in center fish plate and secure.

d. Connect tensioning or ground cables to base plates and tighten turnbuckle until heels of arches are 62' apart and peak is 16' 1" above base plate.

e. Drive stakes through base plate.

Erection of Additional Bays

The assembly and erection of additional bays follow closely the instructions outlined for erection of the first bay. The arch members of succeeding bays are numbered in the same manner, but lettered to identify each bay. In addition, all numbered parts are interchangeable, i.e., A1 may be substituted with B1 or D1, etc.

When erecting the structure the left side is anchored and the right bay is moved into position on the base plates by raising the arch. A said plate, consisting of a flat piece of heavy gauge metal or plywood, is used as a slide to keep the heel of the arches from digging into the ground and facilitate the movement of the right half of the bay (Fig. 4).

As soon as the second bay is in position, the circular wooden spacers are installed. These tie the adjacent arches together. Jacks or pry bars are used to align the holes. Note: It is important that the ridge height and distance between the base plates are constant. Considerable difficulty will be encountered in bolting the center fish plates and wooden spacers if this is not done.

COVERING THE STRUCTURE

Each bay is covered by one continuous exterior blanket. The cover is spread over the bay with the center seam over the ridge member. The edges of the blanket are tucked between the arches and the drawstrings pulled taut and secured at the base of the arch. On the end arches, grommets are used to lace the blanket to hooks provided on the arch members.

The covering for the adjacent bay is spread and secured by tucking between the arch as above. The storm flap of the first arch is then placed over the adjoining blanket and secured in the same manner. The edge of storm flaps should face away from prevailing winds. Ropes are placed through grommets provided on the edge of the blanket and secured to a toggle which fits under the adjoining arches.

The interior blanket is secured by sliding the edges into the aluminum awning rail. The best method of securing the inner blanket is by removing the awning rail from one arch and feeding the canvas on the other side. The canvas that is left hanging is then

fe. into the rails; after which, the rails are screwed into the underside of the arch.

The end sections, as designed, require a study of the working drawings. The gable sections are installed first; after which, the doors are hung.

ADAPTATION SUGGESTIONS

Additional height and cube may be obtained by placing the base plates on raised cement piles (Fig. 23). If these piles are used, the tensioning cables may be eliminated. The piles must be of sufficient depth in the ground to offset the outward thrust of the structure. Additional canvas or other covering will be required to cover the distance between the base plate and grade. For conditions where it is desirable or necessary to raise the floor of the building above ground, a wooden platform may be built. The platform may also serve as a loading dock. The base plates can be bolted to the wooden platform and the building erected as previously outlined. A joist under each arch can be made to counteract the thrust. The building must be adequately braced against the wind. Lumber sizes and footing dimensions depend upon the load conditions and should be determined in the field.

Chain hoists or block and tackle may be suspended from the arches if the jacks, supplied with the structure, are used as lolly columns underneath the point of stress.

Doorways may be cut into the side of the structure if desired. The maximum opening will be the 8' width of the bay. Depending on the required doorway height, some gambellas would have to be removed. The purlins would have to be moved upward to serve as lintels and to maintain rigidity (Figs. 24 and 25).

Corrugated aluminum roofing and siding may be used in lieu of the canvas covering. The corrugated sheets are available in a 35" width and 8'6" or 9' long. This is enough to span one arch allowing for overlapping of sheets. A redesign may be necessary, which would call for placing of the gambella receptacles at the upper edge of the arch to allow the corrugated sheets to rest directly on the gambellas.

The corrugations on the aluminum sheet run lengthwise. A flat sheet may be bent over the curved portions of the arch eliminating the necessity of supplying special pre-formed sheets.



Fig. 23. - Structure raised on cement piles. NSRDF Neg. No. 275-13.

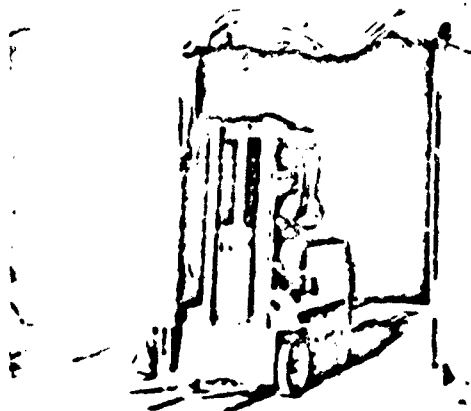


Fig. 24. - Side entry showing sufficient height to permit passage of fork truck. NSRDF Neg. No. 216-5.

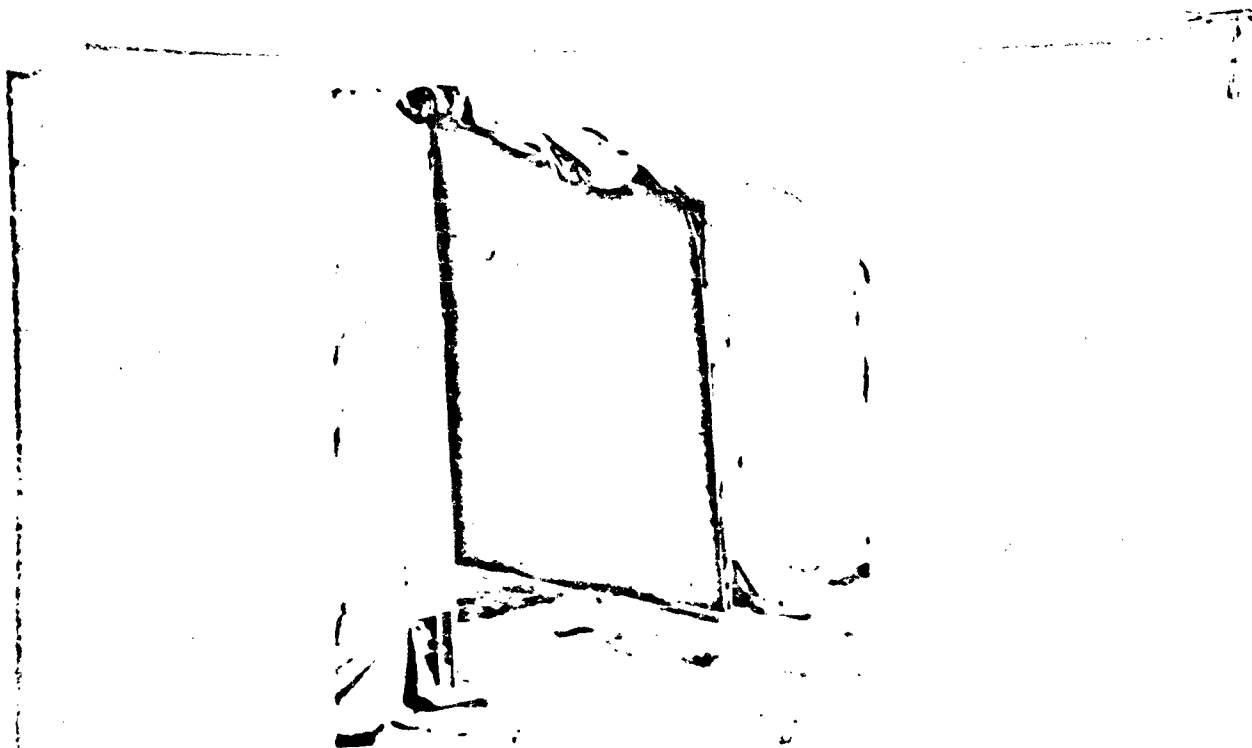


Fig. 25. - Side entry showing (1) substitution of lower gambella unit for upper unit; (2) removal of purlins to height parallel to lowest gambella. A permanent doorway may be constructed from locally available lumber. NSRDF Neg. No. 216-6.

The structure, less the end sections, requires approximately 4,600 sq. ft. of covering, allowing 16% for overlap. One sheet of .024 corrugated 45 aluminum 8'6" x 35' weighs 10.26 lbs. The top covering, therefore, would weigh about 1,850 lbs. and can be shipped on one skid, the aluminum occupying a space less than 6" high.

At \$.19 per square foot, the total cost for 4,600 sq. ft. of aluminum is approximately \$874.00. Labor to apply the covering, estimated at \$.10 per sq. ft., is \$460.00.

Corrugated fiberglass panels are suggested for use as translucent skylights where daylight working areas are advantageous. These panels may be procured in the same sizes as corrugated aluminum; thus, translucent panels may be substituted for any part of the structure.

Advantages and disadvantages of aluminum covering, as compared to canvas, are listed below.

Advantages

1. Aluminum sheets, once applied, require little or no maintenance. Canvas will require adjustments from time to time due to stretching. Should the structure be required for a long period of time, aluminum would be the better covering due to its longer use life.

2. The shipping cube of the aluminum sheets is less than one-fifth that of canvas.

3. The aluminum sheets are less liable to puncture or damage.

Disadvantages

1. The shipping weight of aluminum is approximately 1,850 lbs. as compared to 870 lbs. for canvas.

2. Time involved covering the structure in the field is much longer. An aluminum covering has not been applied and no time studies are available. It is assumed that nailing or screwing the aluminum sheets to the structure will require considerably more time than the pre-fitted canvas covering.

3. The cost of aluminum may be greater than canvas. Although the first canvas cover cost \$9,550.00, as against \$874.00 for aluminum, the cost of the canvas includes the end sections and the interior blanket. The cost of most of the labor involved in covering the structure is already figured in the manufacturing cost of the canvas blanket. The labor cost of applying aluminum must be added to arrive at a comparable figure. In addition, the cost of the canvas blanket will be lower in production. Before procurement, it is suggested that the costs of canvas versus aluminum be closely studied.

INSULATION

The practicability of the interior blanket has not been tested on this structure. A report "Fuel Savings Resulting from the Use of Liners in Tents" Contract No. DA44-109-GM 288, completed by the University of Louisville Institute of Industrial Research for the Quartermaster General, advocates the use of liners in order to save fuel. The structure being evaluated by this Facility, however,

has a greater cube and the distance between the inner and outer blankets is greater. In addition, the spaces between adjacent arches are not sealed. It is recommended that the practicability of the inner liner be tested.

Batt or rigid type insulation may be inserted between the gambellas and the outer skin. The main disadvantage of this type of insulation is its large cubic measurement.

Accordion aluminum blanket insulation is available in 24" widths. Four of these lengths could be stapled together to complete the 8' width. It is available in continuous lengths 500 to 750 ft. long. One type consists of 3 layers of aluminum foil with 2 fiber separators. One thousand square feet of insulation weighs 95 lbs. and packs into 6 cu. ft. This insulation is available with flame, mold, and vermin resistant fiber. One supplier, Infra Insulation, Inc., New York City, lists this type of insulation at \$68.00 per M sq. ft.

If a need for insulation is indicated, it is recommended that this type of insulation be evaluated due to its advantages in cube and weight.

SUGGESTED CHANGES IN FRAME DESIGN

1. The butt ends of each half arch should be redesigned so that the center fish plate may be bolted on the ground and both arches may be raised together. One suggestion would be a wedge that would slip into place after the arches are raised. The wedge would also help prevent the arches from sagging. This sagging is very important for alignment and is especially critical on the outside arches, as the doors at the center of the structure do not hang plumb. In addition, the doors hang lower and cause trouble when opening or closing. The use of wedges should also be considered in the intermediate arch sections to prevent sagging.

2. The drilled holes for spacers did not always line up. The width of the arch members varies and alignment is sometimes difficult. Arches should be laid out in a jig and all holes precision drilled.

3. The lower gambellas should be eliminated and purlins substituted. Under most conditions the insertion of the lower gambella is difficult. If the same strength can be achieved, purlins would be more desirable from an erection standpoint.

4. Only American standard nuts and bolts are to be used. Upon erection, it was found that head sizes of nuts and bolts did not match, thus necessitating the use of many different size wrenches.

5. The tolerance of the bolt holes in the center fish plates should be increased slightly, as alignment is difficult.

6. The placement of gambella fittings should be determined. If the interior blanket is deemed necessary, the gambella fittings should be moved close to the upper edge of the arch. A better bearing surface for the roof covering is achieved by placing the gambellas flush with the upper edge of the arch. If the interior blanket is eliminated and rigid or blanket insulation substituted, the space would be required between the gambellas and the roof covering.

SUGGESTED CHANGES IN COVER AND END SECTION DESIGN

The exterior blanket, as designed, requires improvements before it is acceptable. Appendix C contains revised drawings of the exterior blanket incorporating changes as described below:

1. The drawstrings provided in the exterior blanket are of little value because of the long span from the ridge to the knee. Force exerted on the drawstring is not enough to keep the edges of the blankets between the arches. One solution to the problem was to place grommets along the edges of the blankets. A rope is secured to a toggle and passed through these grommets and tied to the toggle with a clove hitch. The toggle will then be snubbed underneath the arches. Tension on the exterior blanket can be maintained by periodic retightening of the toggle assembly.

2. The drawstrings on the storm flaps lack the ability to keep the storm flaps in place. This condition was corrected by providing straps on the flap and buckles on the adjacent blanket.

3. The exterior blanket, as originally designed and supplied, was too narrow to span the edges of the arch members. Corrections have been made on the drawings allowing 6" more on the width of the blanket so that it may be secured between the arches.

4. All stitching on the canvas covering must be lock stitch. During hurricane "Hazel", in October 1954, some stitching gave way causing the exterior blanket to rip almost its entire length. The force of the wind caused additional tearing due to severe flapping.

of the ripped seams. Upon inspection, it was found that some seams on the blanket were bag stitched, a method of sewing which opens easily by pulling the thread on the bottom surface.

Another method of preventing lengthwise rips is to sew bands across the width of the blanket at the location of the rings and straps. These strips can be used for backing instead of small aprons of canvas at small additional cost.

Interior Blanket

1. The interior blanket or tent liner does not completely seal the structure. The 2" space between adjacent arches is not sealed. There is a gap at the peak where no seal is effected. In addition, they are not long enough and a space is left between the bottom of the blanket and ground level.

2. Installation of the liner was difficult and time consuming. It was difficult to draw the blanket through the awning rail due to friction. The rail had to be removed from the arch, attached to the blanket, and then refastened to the arch.

3. The awning rail was susceptible to denting and added to the friction during installation. When removing the inner blanket during dismantling, most of the awning rail was damaged beyond economical repair. Additional awning rail would have to be supplied each time the structure is moved.

If a liner proves practicable, it is suggested that another method of insulating the structure be designed to completely seal the structure and ease the difficulty in installation.

End Sections

The end sections, as designed, have many disadvantages, and it is suggested that they be completely redesigned. The objections are as follows:

1. The 1/4" plywood facings, and the structural members with their connecting hardware, make the panels too heavy for the intended use as an air-transportable structure. Although the sections will fit within an air frame, they are heavy and unwieldy.

2. The weight of the door panels appears too great on a span of 62', causing the corners to hang lower than the others, thus dragging the

3. The accordion type doors require toggle plates (Fig. 11), which fit over the reverse side of the hinged folds, to keep them in a straight line. If these plates were not added, it would be almost impossible to keep the doors straight when closed. These added plates require time to bolt in place and reduce the efficiency of the structure.

4. The doors, when folded, (Figs. 26 and 27) occupy usable warehouse space. The swivels should be moved from the center of the door panels to the edges so that the folded doors will remain outside the structure. This improvement is suggested if the accordion type door is to be procured.

The main disadvantages are the weight and size of the component parts, (approximately 550 lbs.). It is recommended that some other design and materials be used. An adequately designed basic frame covered with canvas, aluminum, or plywood on one face, would considerably reduce the weight.

5. Due to the inadequate design of the end sections, it is recommended that an Army designed canvas end section (Fig. 28), be procured and then evaluated at the next test site. Discussions with Army project engineers evaluating the Army structure indicated that no difficulties were encountered in operating the end sections during field tests. An evaluation report has been prepared on this structure, QMRT QMBT 53123 Test, Hangar, Maintenance, Army Aircraft T52-1, -2 by Headquarters, Quartermaster Research and Development Field Evaluation Agency, Fort Lee, Virginia. This structure is primarily an aircraft hangar and, therefore, the end sections are raised in one piece. A complete end opening is not required for air cargo purposes and it is suggested that the end openings be divided into 10 or 15 ft. vertical flaps to permit passage of mobile materials handling equipment. This could be accomplished by the use of heavy duty zippers.

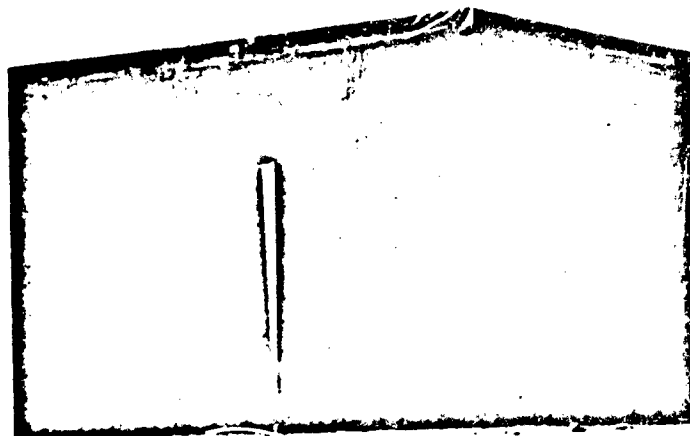


Fig. 26. - Accordion type doors partially open. Toggle plates have loosened to permit folding back of doors. NSRDF Neg. No. 216-7.

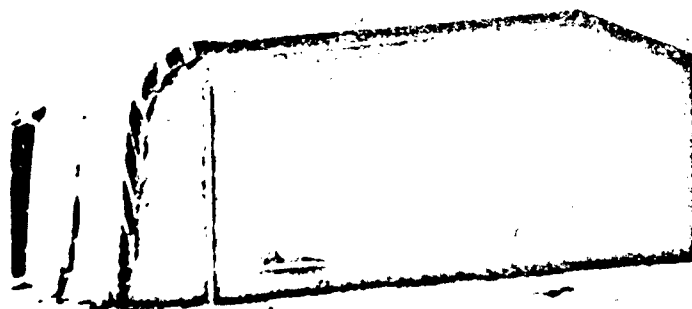


Fig. 27. - Accordion type doors folded to provide maximum opening on left side. NSRDF Neg. No. 216-8.

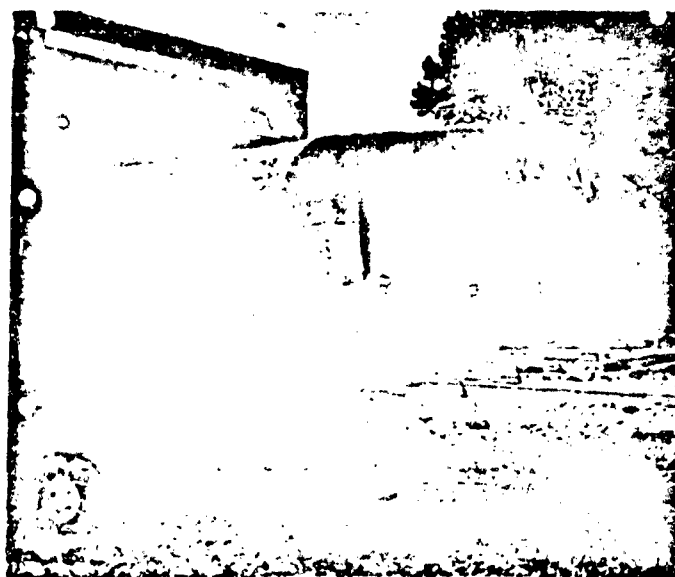


Fig. 28. - Tent, frame type, maintenance, Army aircraft, T52-2, showing aircraft door open. U. S. Army QMC Print No. 3167-19. NSRDF Neg. No. 314-1.

COST BREAKDOWN - TEMPORARY AIR CARGO TERMINAL

Cost of frame (6 repeating 8' bays)		\$ 9,162.00
Cost of canvas covering including outer and inner blanket and end sections		
1. Development and design	\$4,242.00	
2. Manufacturing costs ⁽¹⁾	9,550.35	<u>13,792.35</u>
		\$22,934.35

(1) It is to be noted that the manufacturing costs included here pertain to the prototype. The cost of any future unit(s) will be reduced by a considerable amount.

CONCLUSIONS

1. The frame structure, as designed, may be transported by air to remote locations and erected by unskilled labor without the use of heavy construction equipment.
2. The end sections require complete redesign due to difficulty in closing and high weight characteristics.
3. The canvas cover, (both external and internal blankets) as designed, requires minor modifications to seal the structure and resist high winds and weather.

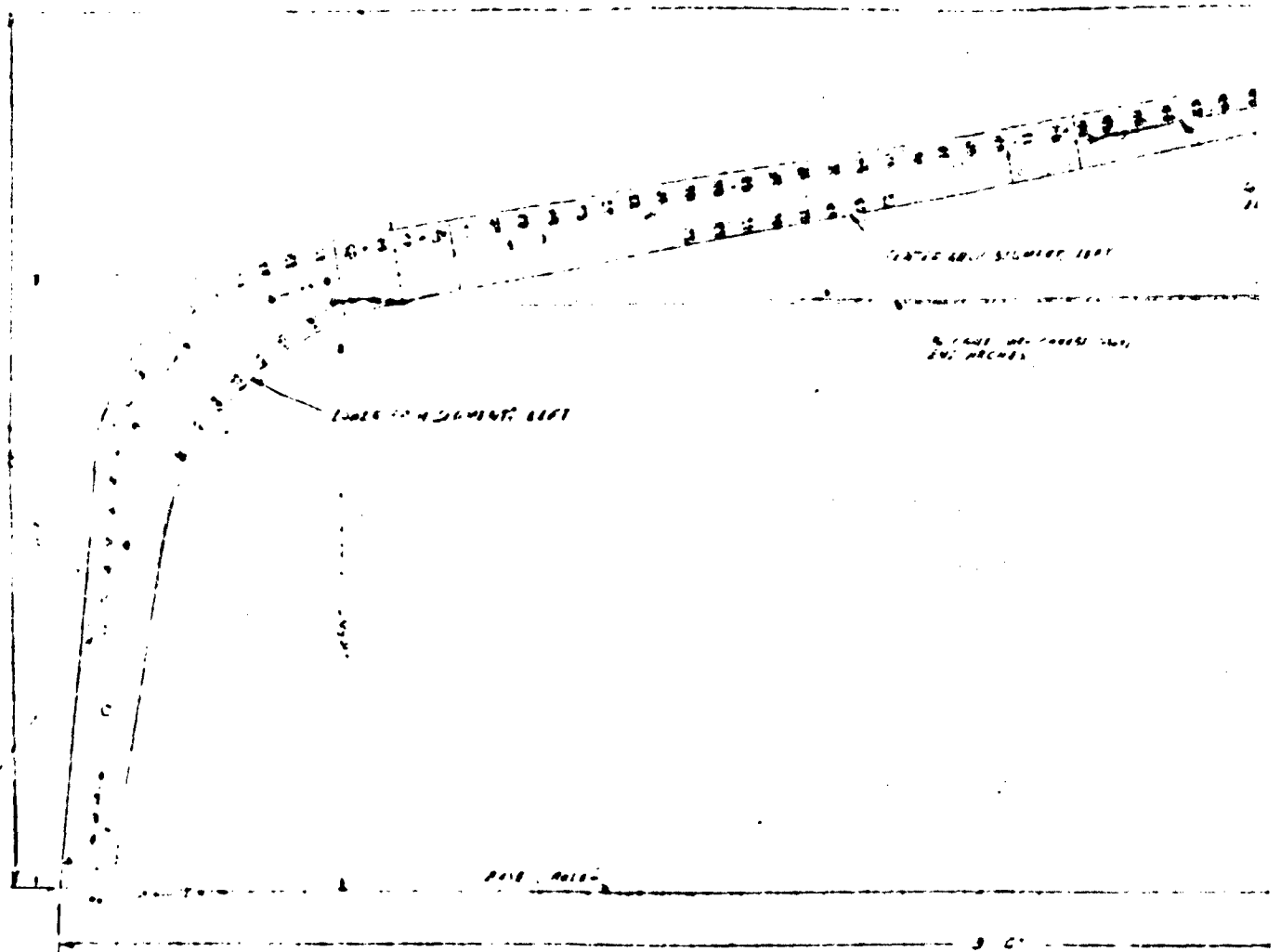
RECOMMENDATIONS

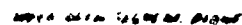
The following recommendations are made:

1. That new end sections be designed to provide maximum flexibility, lightness and portability consistent with strength and ease of erection; or, that an Army designed canvas end section be procured and evaluated.
2. That the method of securing the canvas covering (external and internal) be modified to resist high winds and weather.
3. That an operational evaluation of the structure be made to determine door and/or side opening arrangements which best suit the peculiar needs of an air cargo terminal.
4. An operational evaluation be made of the structure at an operating airfield in order to determine effectiveness of layout and cube of a six bay assembly.
5. An evaluation be made of various methods of covering the structure (corrugated aluminum, cocooning, etc.). The study is to involve comparisons as to cost, labor, time, durability, weight and cube.
6. That the butt ends of the arch be redesigned in order that both halves of the arch may be joined on the ground and raised together, and that ferrules be placed on the ends of arch sections to prevent splitting.
7. That the insulation value of the inner blanket be determined and alternate means of insulating the structure be investigated.

8. That the inner blanket or liner be redesigned to seal off the spaces between the bays and around the base plates, and an easier method of installation be determined.

9. That all bolts be cadmium plated.





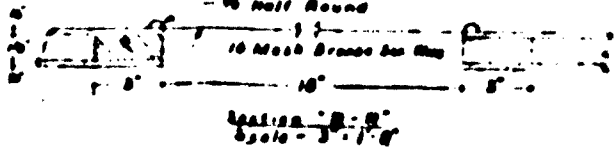
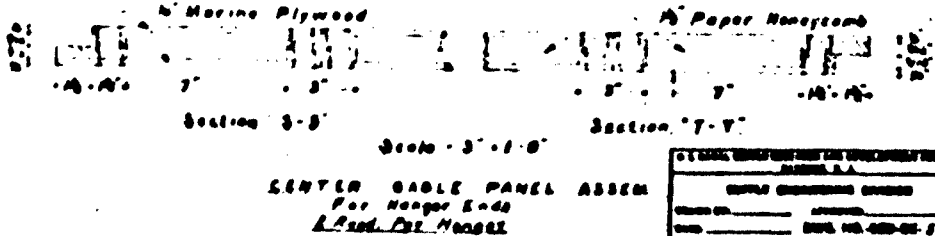
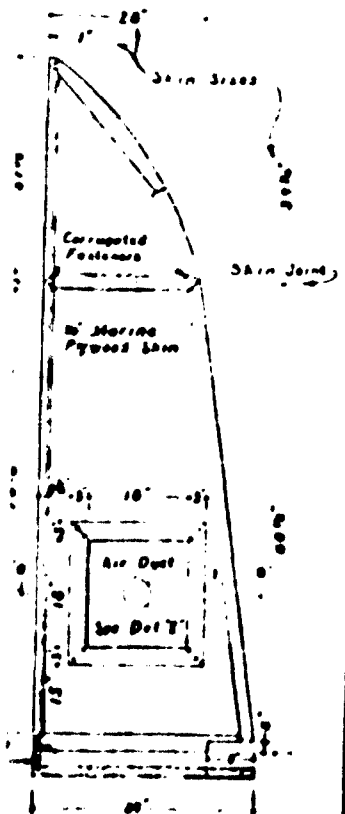
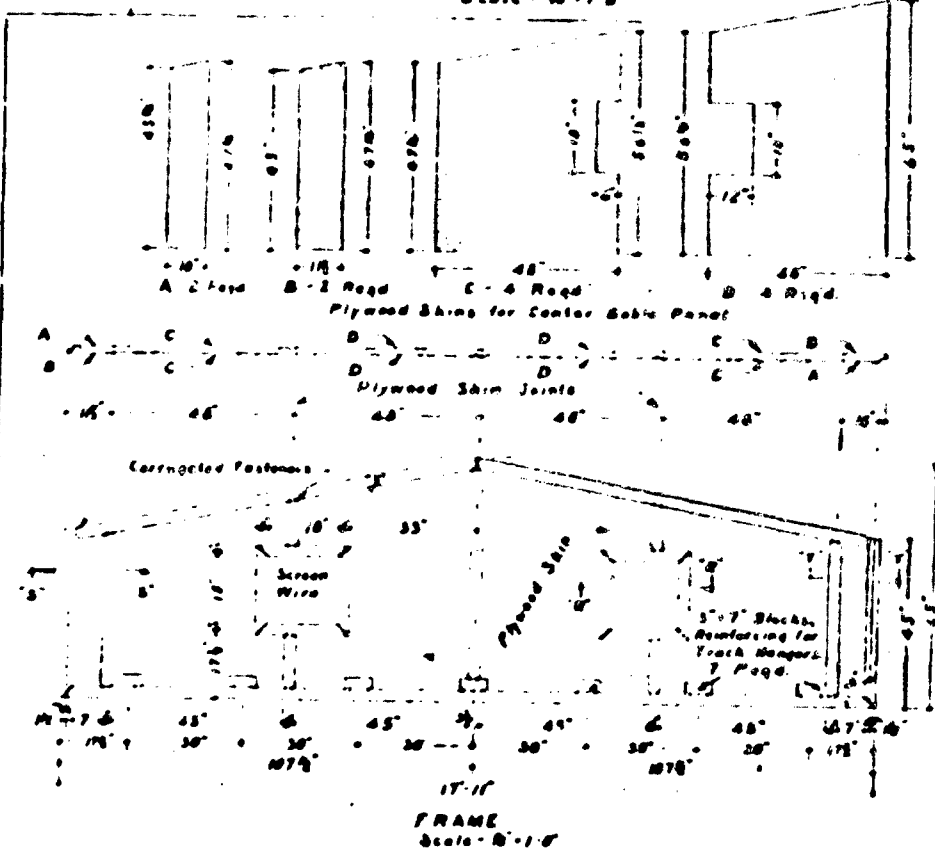
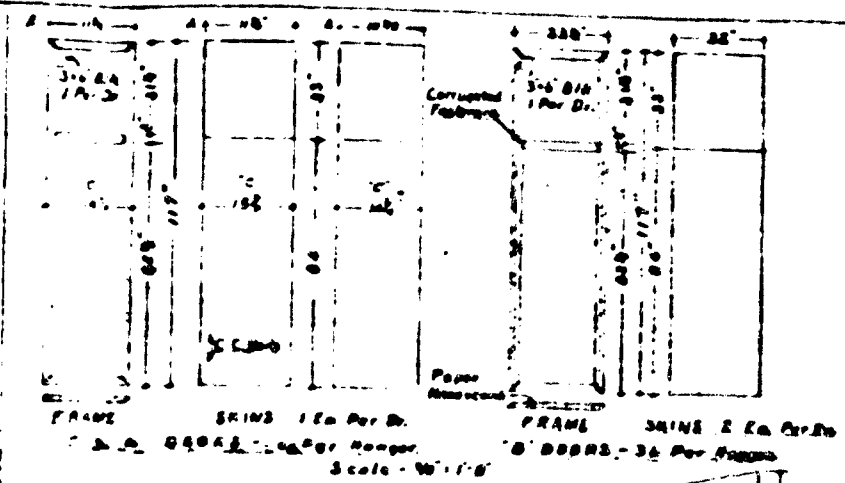
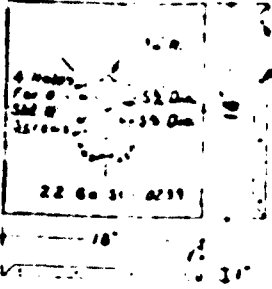
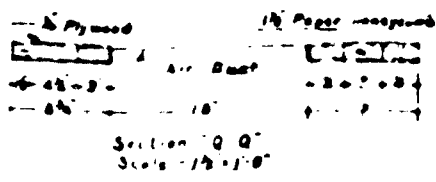
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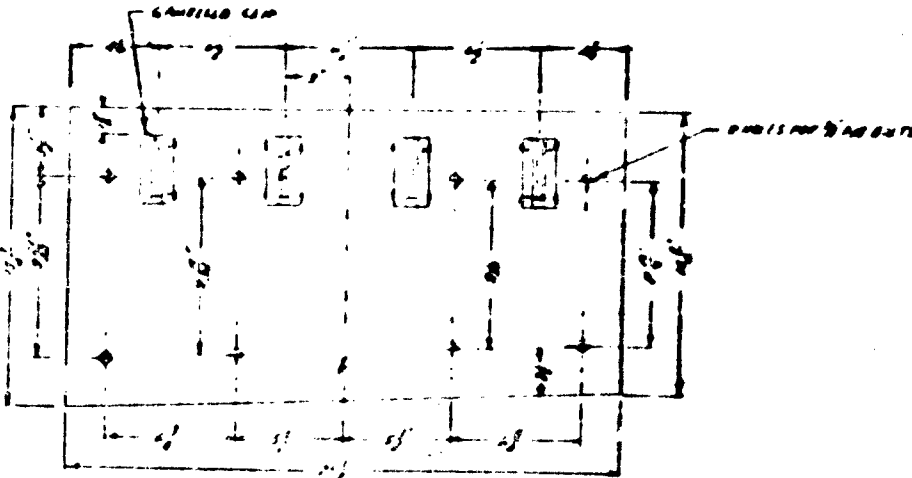
REC-41441

PERMANENT RECORD DATE _____ TIME _____		GAMBLE BROTHERS ENGINEERS	
NO. <u>1177</u> SITE <u>LOWVILLE BRIDGE</u>		<u>22' HIGH, 11' WIDE TYP. GAMBLE</u> <u>62' SPAN, 5' MODULAR SECTION</u> <u>ARCH BRIDGE</u>	
By <u>WILLIAM</u> Checked by <u>W.H.</u> Drawn by _____ Approved by <u>W.H.</u>	Date <u>SEP 1</u> Location during making _____ <u>SEE PL. 6-20</u>		

4) INDEX 3 520-47.

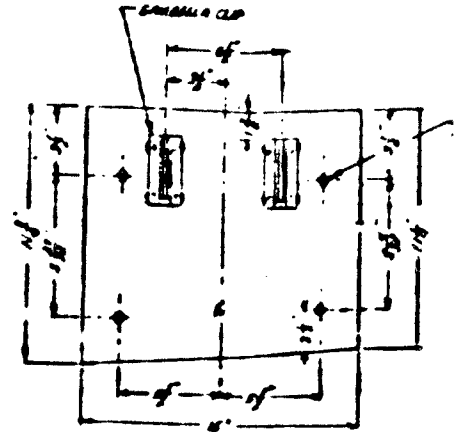


THE CAL-TEX CO.	
1940	
HANGER, FRAME TYPE, AIRCRAFT MAINTENANCE, 10-25	
Drawn by	Checked by
Designed by	Approved by



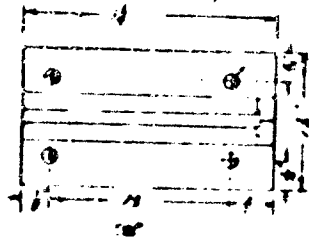
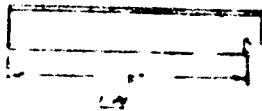
PLATE, CONNECTOR 'A'

STEEL 1015 THICK
20 H000 WITH 5/16\"/>



PLATE, CONNECTOR 'B'

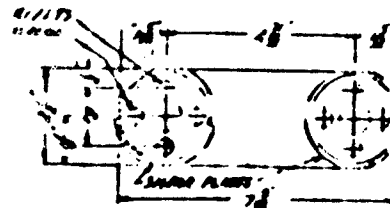
STEEL 1015 THICK
20 H000 WITH 5/16\"/>



FEMALE GAMMA CLIPS

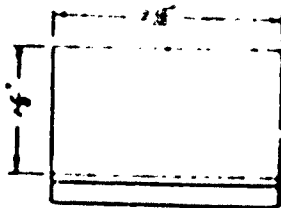
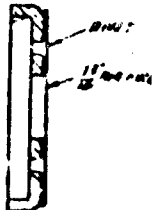
200 17711 1024 2100-000

HOLE FOR 1/2\"/>



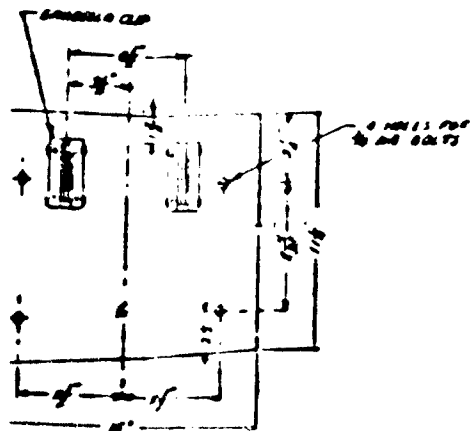
PLATE, REINFORCEMENT

20 H000 17711 1024 2100-000

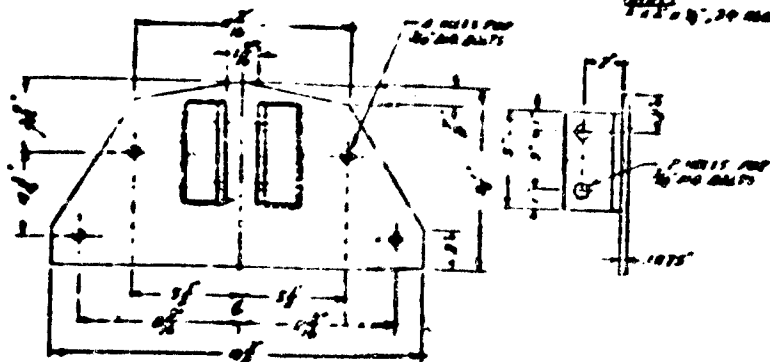


MALE GAMMA CLIPS

200 17711 1024 2100-000



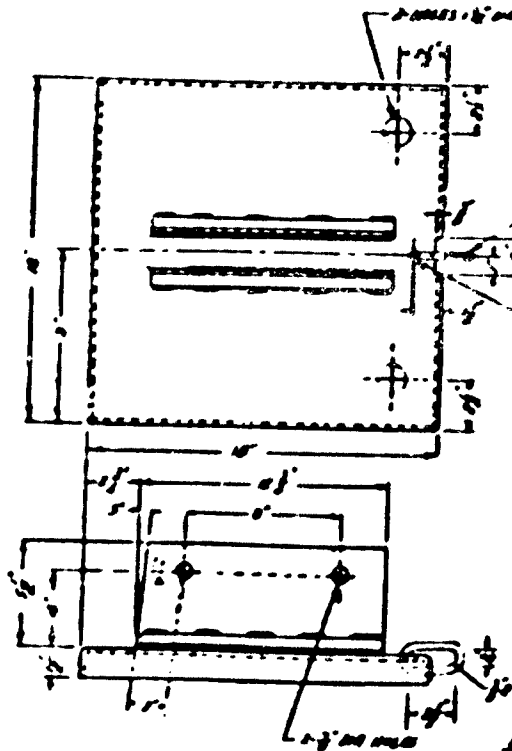
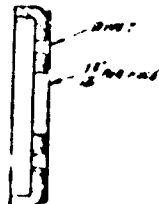
PLATE, CONNECTOR 'B'
 STEEL 101.1 T.M. 1/4
 1/2" WIDE 1/4" DEEP 1/2" LONG
 1/2" WIDE 1/4" DEEP 1/2" LONG
 1/2" WIDE 1/4" DEEP 1/2" LONG



PLATE, CONNECTOR 'C' (SHOWN)
PLATE, CONNECTOR 'D' (SHOWN)
 1/2" WIDE 1/4" DEEP 1/2" LONG

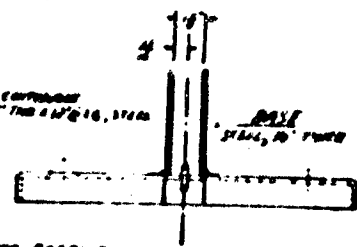


FORCING
 1/2" WIDE 1/4" DEEP 1/2" LONG

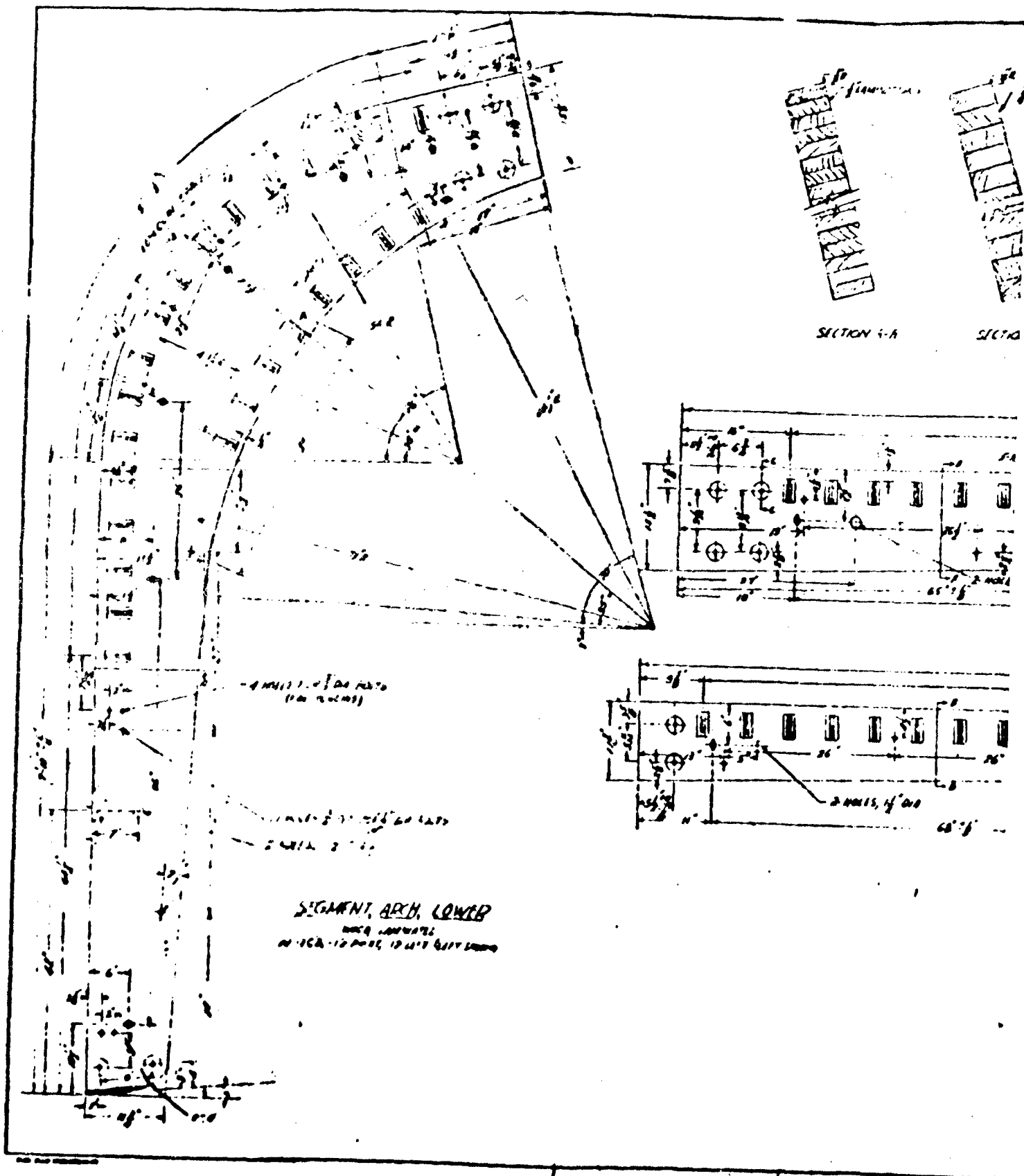


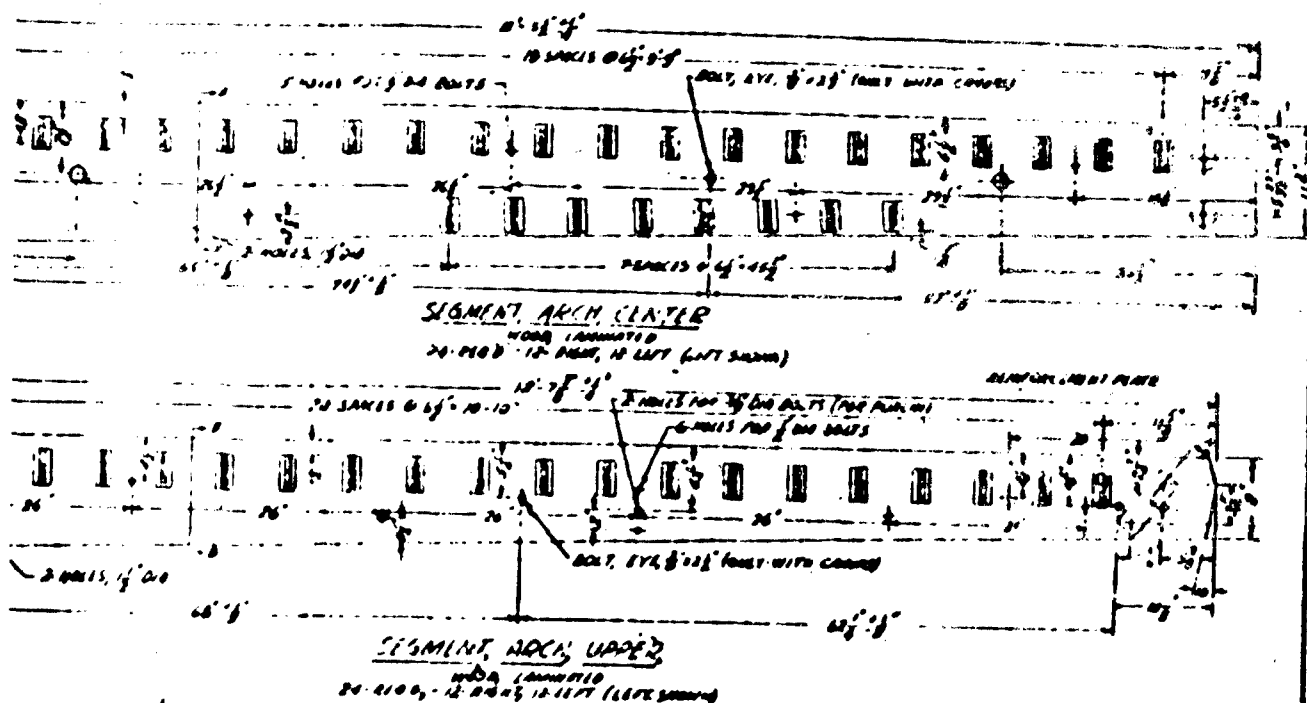
BASE PLATE ASSEMBLY
 1/2" WIDE 1/4" DEEP 1/2" LONG

BASE PLATE ASSEMBLY
 1/2" WIDE 1/4" DEEP 1/2" LONG



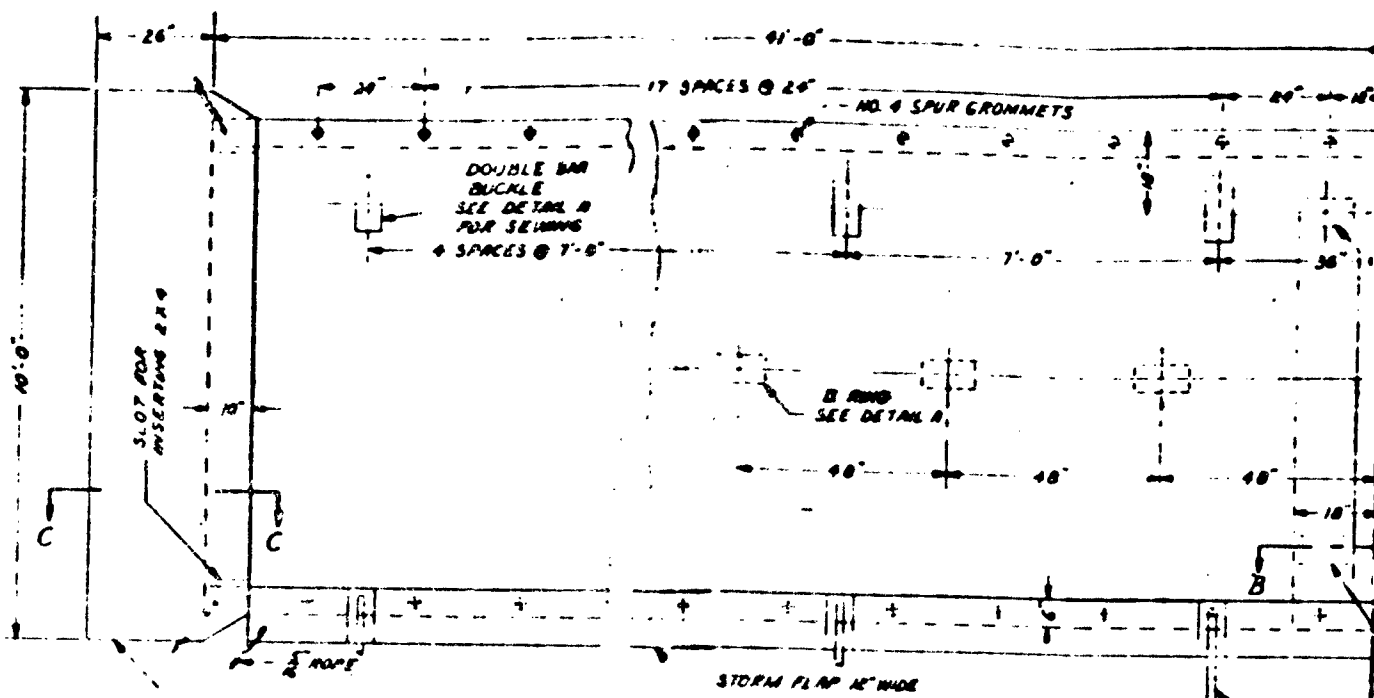
REVISIONS		GAMBLE BROTHERS	
NO.	DESCRIPTION	DATE	BY
1	SHUTTER FRAME TYPE, GAMBLE		
2	62' SPAN, 8' MODULAR SECTION		
3	WITH CONNECTIONS		
4	REVISION		
5	REVISION		
6	REVISION		
7	REVISION		
8	REVISION		
9	REVISION		
10	REVISION		



[illegible]

SECRET 2 SEP-77

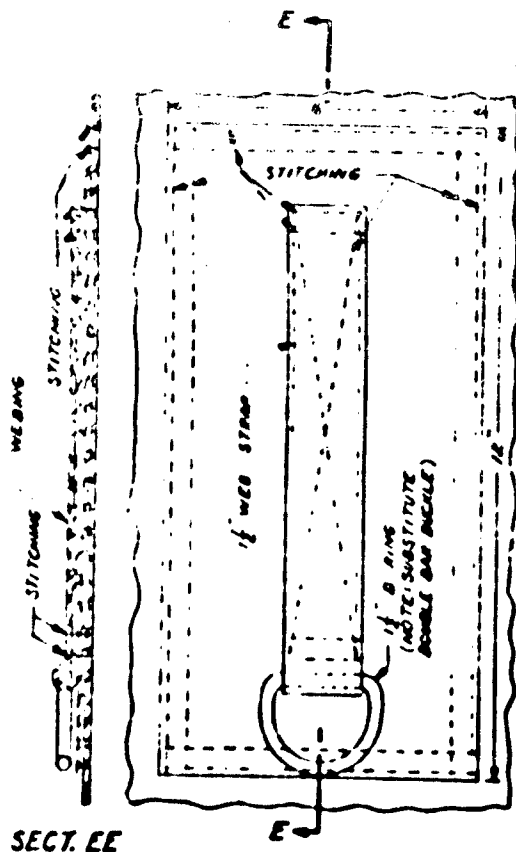
2—



PLAN VIEW

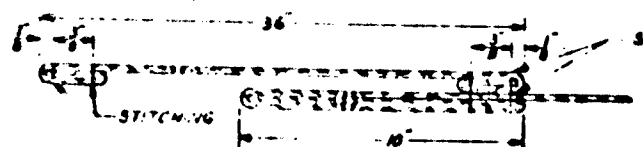
VINYL COATED - OD - TYPE E - CLASS A - SPEC. M.L.F. 9143

WE.
18"
WIT.
SEE
FG

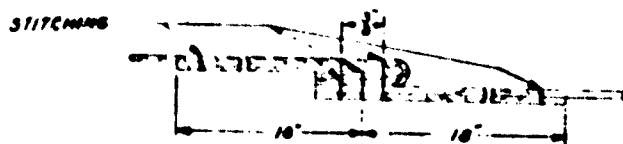


SECT. EE

DETAIL A

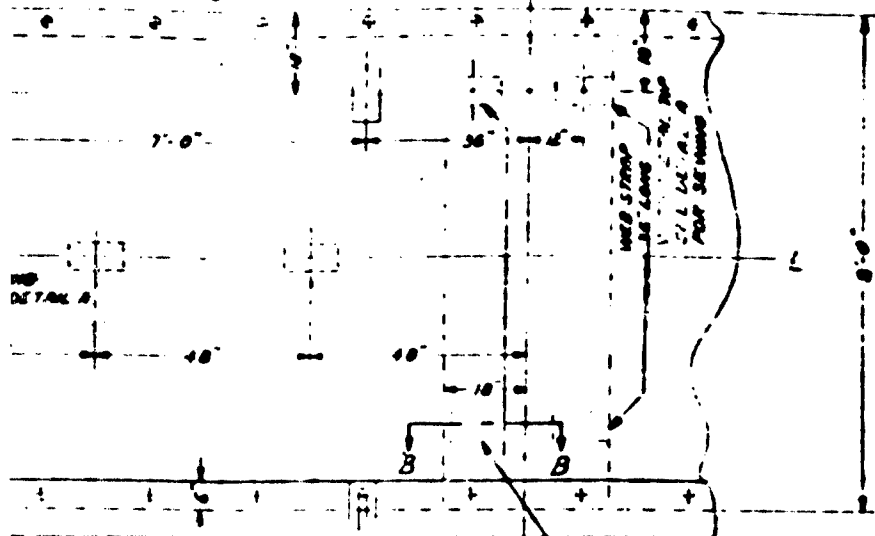


SECTION CC



SECTION BB

6. 8 SPUR GROMMETS

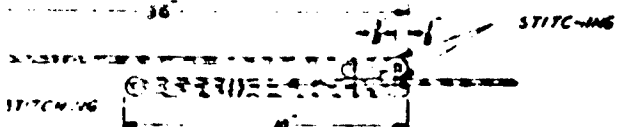


VIEW

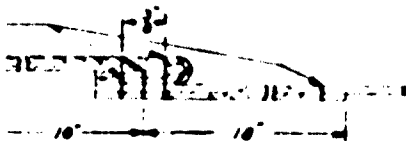
CLASS A SPEC. MIL. F. 9143

WEB STRAP
18" LONG
WITH METAL TIP
SEE DETAIL A
FOR SEWING

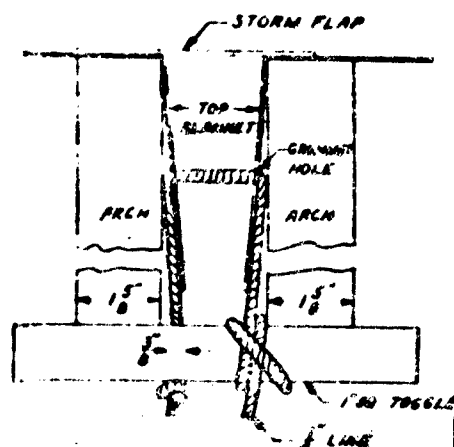
DOUBLE BAR BUCKLE
SEE DETAIL A
FOR SEWING



SECTION CC

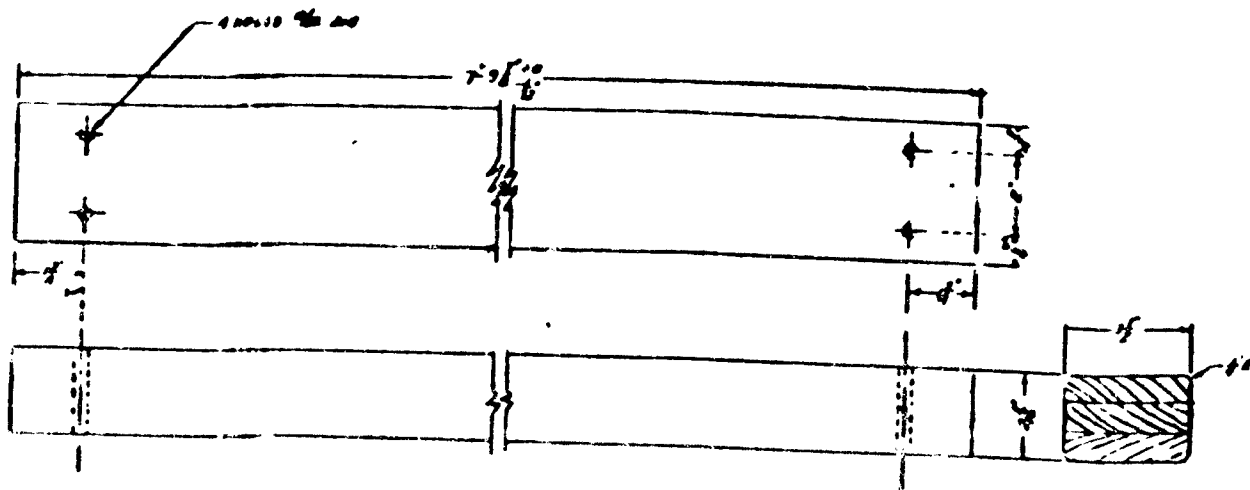


SECTION BB

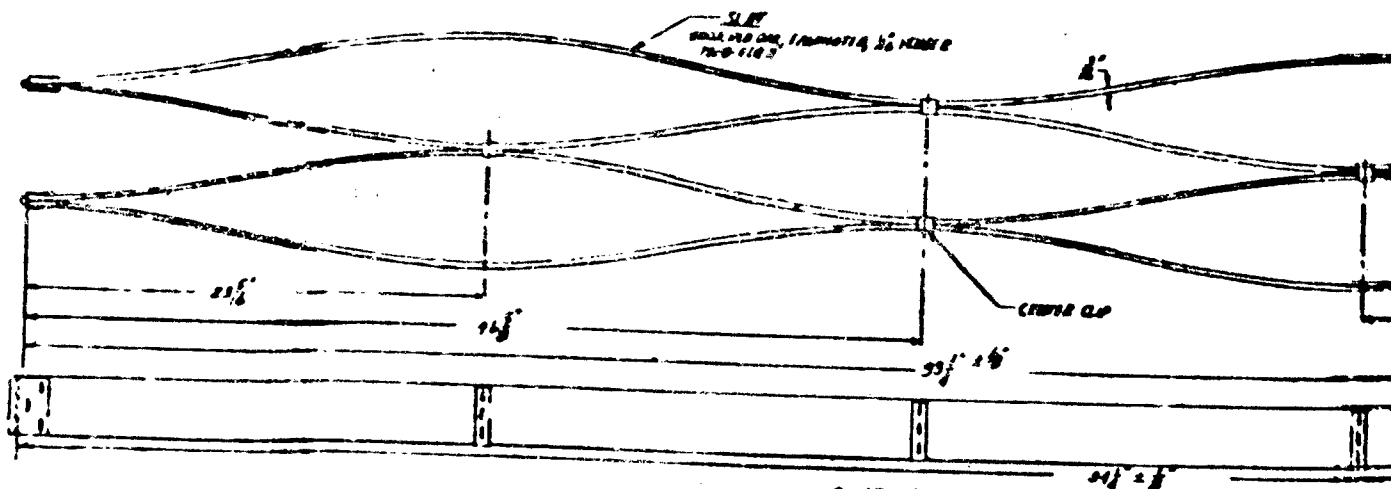


METHOD OF SECURING
TOP BLANKET

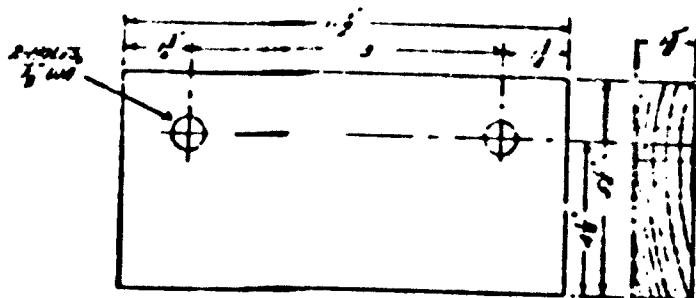
REV.	DATE	REMARKS
<p>DEPARTMENT OF THE NAVY BUREAU OF SUPPLIES & ACCOUNTS</p>		
<p>CANVAS COVERING TEMPORARY AIR CARGO TERMINAL</p>		
<p>U. S. NAVAL SUPPLY RESEARCH AND DEVELOPMENT FACILITY SUPPLY ENGINEERING DIVISION BAYONNE, N. J.</p>		
DESIGNED BY	APPROVED	
DRAWN BY	DATE	
CHECKED BY		
SCALE	DWG. NO. SED-531	



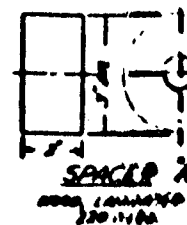
BEAM, 29 $\frac{1}{2}$ IN. LONG
34-2000



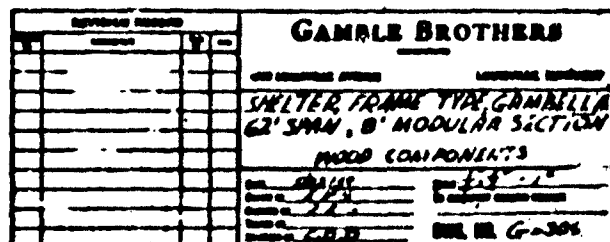
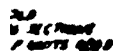
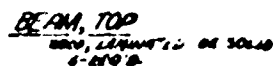
SLAT ASSEMBLY
SECTION SHOWN IS ENLARGED
FULL UNIT - 100 IN. BY 12 IN. SECTION
90 FULL UNITS AND 10 HALF UNITS USED



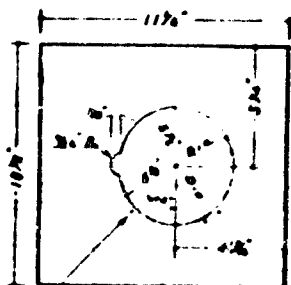
SPACER "B"
110 IN. LONG BY 4 IN. WIDE
34-2000



SPACER
110 IN. LONG BY 4 IN. WIDE
34-2000



44 JANET I SED-4N

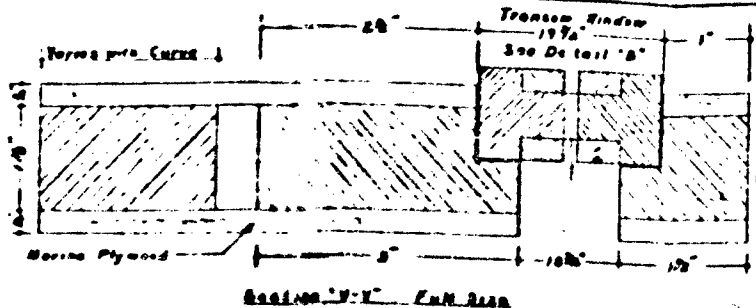


4 Holes for #4 Sheet Metal Screws.

4 Holes for No. 8 Barry Box Nails.

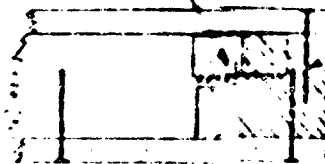
HEATER DUCT OPENING PLATE
Size: 5" x 10"
Made of 22 Ga. Galv. Sht Metal - C238

DETAIL "A" 1 Req'd Per Van



Section "Y-Y" Full Size

2 Cor Fasteners



DETAIL "D" Full Size

Cement Coated Box Nails - 4" G.C.

Corrugated Fasteners

Heater Duct Frame See Detail "A"

Transom Window See Detail "B"

Barry Line

See Detail "D"

Personnel Door See Detail "C"

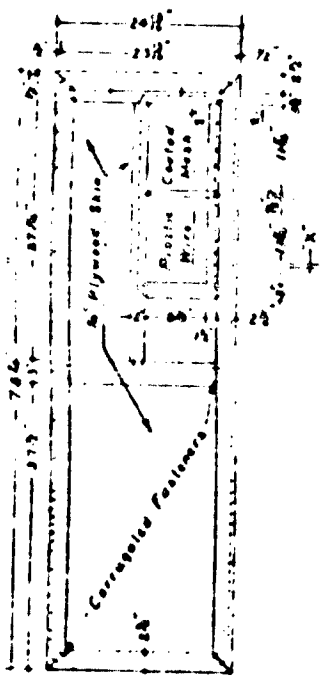
Threshold

FRAME
Bottom View

WIND PANEL

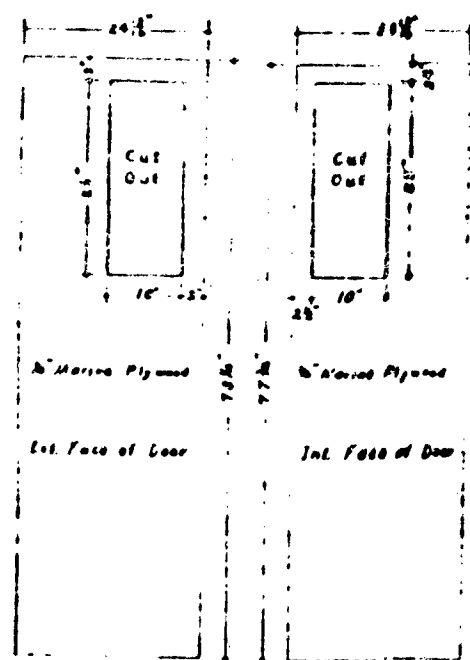
-NOTE-

All joints shall be glued with mastic
All frame joints shall be secured with
Fasteners and nails where needed
All plywood skin shall be glued & nail
All hollow spaces filled with #2 Pop
Req'd. Nails are per Assembly.



FRAME

Bottom View



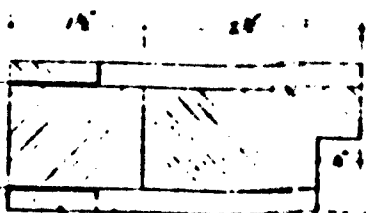
SKIN

SKIN

Section "X-X"

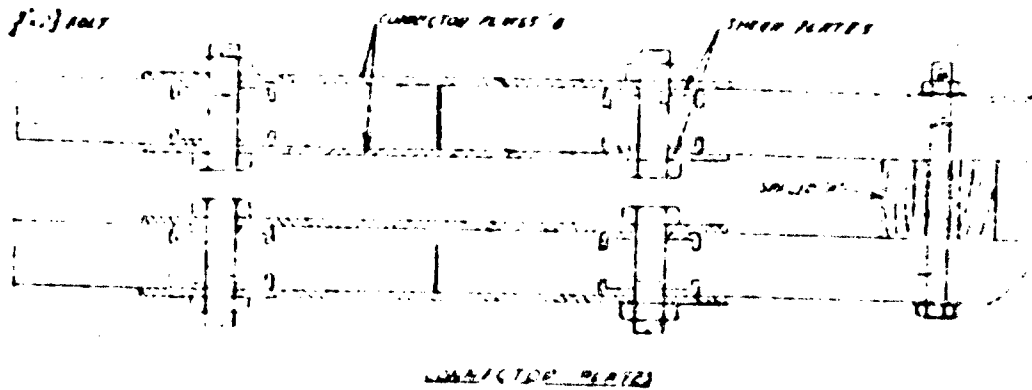
PERSONNEL DOOR
Scale: 1/2" = 1'-0"
Made of W.P. & Marine Ply
DETAIL "C" 1 Req'd

NOTE - Glue all joints

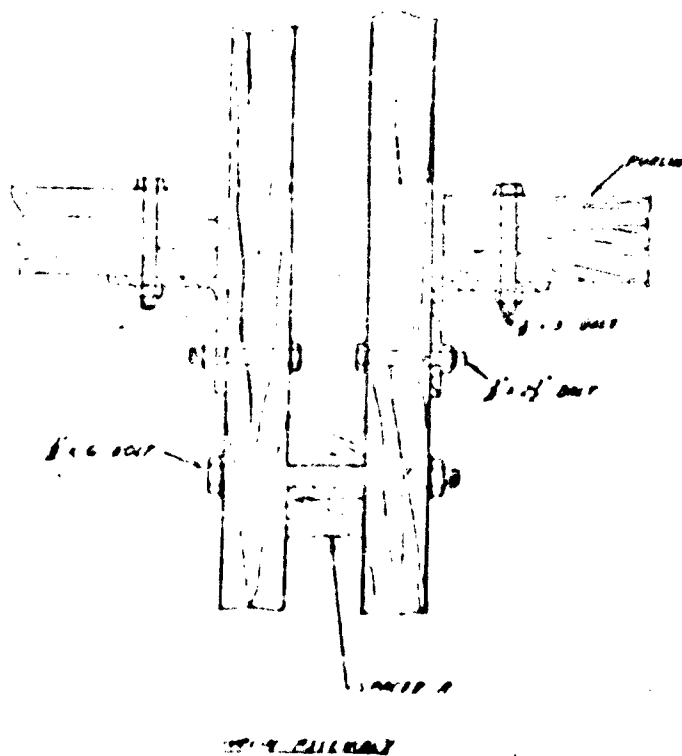


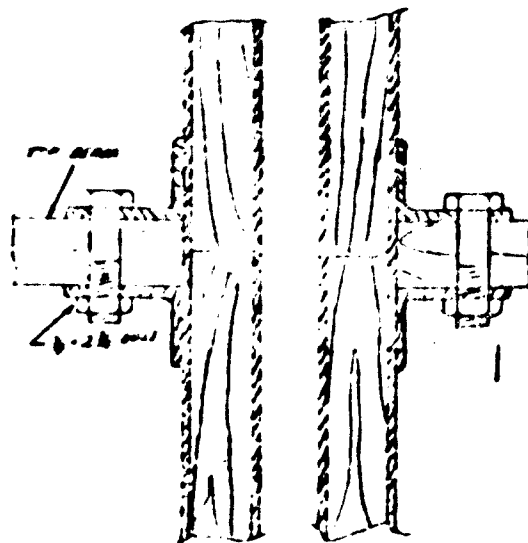
Section "X-X" Full Size

Fig. 1

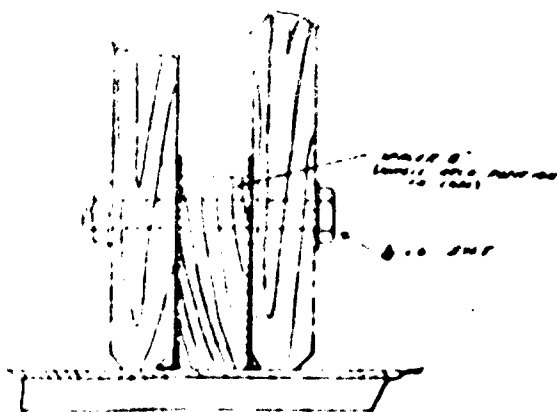


CONNECTING PLATES





RIPPLE CONNECTION



RIPPLE CONNECTION

REVISIONS		GAMBLE BROTHERS	
NO.	DATE	BY	REASON
1	10/1/52	J. L. G.	REVISIONS
2	10/1/52	J. L. G.	REVISIONS
3	10/1/52	J. L. G.	REVISIONS
4	10/1/52	J. L. G.	REVISIONS
5	10/1/52	J. L. G.	REVISIONS
6	10/1/52	J. L. G.	REVISIONS
7	10/1/52	J. L. G.	REVISIONS
8	10/1/52	J. L. G.	REVISIONS
9	10/1/52	J. L. G.	REVISIONS
10	10/1/52	J. L. G.	REVISIONS
DRAWN BY: J. L. G. CHECKED BY: J. L. G. APPROVED BY: J. L. G.		PROJECT: 62' SPAN, 8' MODULAR SECTION SHEET: 1 OF 1 DATE: 10/1/52	

SHEET 1 520-421